PSNH

Public Service of New Hampshire

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July 7, 1983

SBN-530
T.F. B7.1.2

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing

References: (a) Construction Permits CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444
(b) PSNH Letter, dated April 14, 1983, "Response to Generic Letter 82-33; Supplement 1 to NUREG-0737," J. DeVincentis to G. W. Knighton

Subject: Seabrook Station Control Room Design Review

Dear Sir:

In Reference (b), it was indicated that a report on the results of a Detailed Control Room Design Review as required by NUREG-0737 (Item I.D.1) and its Supplement 1 would be submitted by August 31, 1983.

In fulfillment of this commitment, we have enclosed ten (10) copies of our report entitled, "Seabrook Station Control Room Design Review."

The enclosed report also addresses the Safety Evaluation Report (NUREG-0896), Outstanding Item #19 (reference Section 18).

Please notify me if additional information is required prior to your on-site review which has been scheduled for July 26-28, 1983.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

John DeVincentis
Project Manager

ALL/pf
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1/10

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SEABROOK STATION

CONTROL ROOM DESIGN REVIEW

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SEABROOK CONTROL ROOM DESIGN REVIEW

I. INTRODUCTION

In response to the NRC task action requirements established in NUREG-0737 and its Supplement 1, Public Service Company of New Hampshire (PSNH) has conducted a Control Room human factors design review. This review has identified potential Human Engineering Discrepancies (HED) in the design of the Seabrook Station Control Room. These potential HEDs which were identified have been reviewed to see if they affect the safe operation of the plant. Those that did were, in turn, evaluated to see if there was a need to make modifications in procedures, in training, or to the Control Board.

NUREG-0700, Guidelines for Control Room Design Reviews, Draft NUREG-0801, Evaluation Criteria for Detailed Control Room Design Review, and the GE BWR Owners Group Criteria were used as a base for the development of our own criteria for the review. After our criteria were developed, they were used for the review process.

The review process was divided into several parts - operator interviews; a Control Room survey which include hardware, control boards and panels, and alarm system; and procedure walk-through and talk-through sessions.

The Control Room survey operator interview and the procedure talk-through and walk-through portions of the review have been completed. The potential human engineering discrepancies have been listed, and appropriate fixes developed for them where it has been judged necessary. Many of these changes are underway at this time because of schedule commitments.

Some items will not be evaluated at at this time. These are items which require the Control Room to be complete and the plant operational. Included are such items as noise studies, communications evaluation, HVAC evaluation and Control Room operational procedures for shift change. These items will be reviewed during the plant's initial operating cycle, and any necessary changes will be implemented.

II. BACKGROUND

A. Industry Human Factors Activity

Since TMI, increased emphasis has been placed on human factors engineering within the industry. New industry groups have been formed and workshops have been conducted. Many projects aimed at increasing the understanding of operator performance and decision making have been initiated by EPRI and by INPO. The Westinghouse Owners' Group has developed Task Analyses and Emergency Operating Procedures for their plants. The BWR Owners' Group has taken the initiative in performing Control Room design reviews on BWR plants. Yankee Atomic Electric Company (YAEC) and PSNH have taken an active role in all of these activities - most notably the BWR Owners' Group Control Room design review, the INPO activities and the Westinghouse effort.

The reason for this increased emphasis is the perceived need to increase the effectiveness and performance of the operator. Some of the specific areas now being addressed include the layout of control panels and work stations, adequacy of the information presented, Control Room staffing, training of the operators, and emergency procedures used by the operators. The objective of this activity is to decrease the probability of operator error and to improve the detection and correction of operator errors.

B. Prior Control Room Design Review Activity

The Main Control Board (MCB) for Seabrook has undergone extensive design reviews during the course of its development. The basic layout of the MCB was developed by YAEC and PSNH, assisted by United Engineers and Constructors (UE&C).

Two major reviews of the MCB for operability and maintainability were performed. The first major review was performed in the time period from June - August, 1975. A full size mockup of the MCB was reviewed by personnel from YAEC, Central Maine Power, PSNH and

UE&C. These persons had extensive engineering and operating experience, much of it obtained in other operating nuclear plants. This expertise ensured the performance of a thorough operational analysis and review. This review process resulted in significant changes and improvements to the MCB. Details of this review are on file at YNSD offices.

The second major review of the MCB was performed in October of 1980, and included changes recommended by the Seabrook Operations Department. These changes were developed as a result of the acceptance testing of the Seabrook Station Simulator. Participating in this review were YAEC, PSNH and UE&C. Details of the results of this review are also on file at YNSD offices.

Although not formally called "Human Factors" reviews, these reviews did in fact address many human factors concerns. In addition, YAEC/PSNH involvement has been maintained throughout the development of Control Board philosophies.

III. DISCUSSION

The present detailed Control Room design review for Seabrook Station has been accomplished in accordance with the guidelines provided in the referenced NRC documents. Specifically, the design review responds to the requirements contained in Section 5 of Supplement 1 to NUREG-0737, Generic Letter 82-33.

The objective of the Seabrook Station Control Room design review is to improve the ability of nuclear power plant Control Room operators to prevent accidents or cope with accidents if they occur by improving the information provided to them. This design review identifies any modifications of Control Room configurations that the review team feels will contribute to a significant reduction of risk and enchancement in the safety of operation. Decisions to modify the Control Room have included and will continue to include consideration of long-term risk reduction and any potential temporary decline in safety after modifications resulting from the need to relearn maintenance and

operating procedures. This will be carefully reviewed by persons competent in human factors engineering.

A. Review Teams

Qualified multi-disciplinary review teams using a review program incorporating accepted human engineering principles have been established.

Management Review Team

A management team composed of representatives from YAEC and PSNH was established to review the overall progress of the Control Room review. The team members have expertise in the areas of operations, administration, and project management.

Survey Team Composition

The survey team for the Seabrook Station Control Room review consisted of a core group of persons experienced in program management, plant operations, instrument and controls engineering, and human factors engineering. This core group was aided as required by persons experienced in other disciplines.

Seabrook Station, through Yankee Atomic Electric Company, contracted with the firm of Thomas B. Sheridan Associates to provide human factors engineering expertise. The qualifications of the survey team are contained in an appendix to this report.

B. Function and Task Analysis

Function and task analysis has been done by the Westinghouse Owners' Group to be used both in the performance of a Control Room human factors review and in the development of Emergency Operating Procedures (EOP). These were available to our Human Factors consultant for his use during the review of Seabrook Station. It was determined by our consultants that task analyses, procedure

talk-throughs and follow-up walk-throughs must be considered as a single inseparable effort. They consider that a proper model of operator action can best be obtained by observations based on actual talk-throughs and walk-throughs of procedures. The talk-throughs involved senior Seabrook operating personnel and the HFE consultants. The purpose of the talk-throughs and subsequent walk-throughs was to: (a) simulate actions by operators in operating, managing and maintaining safe operation of the plant; (b) identify errors stimulated by design inadequacies; (c) exercise most elements of the Main Control Boards that are frequently used, or for which human error probably is considered significant due to high usage or potential impact on plant operation.

The actual talk-through was an unconstrained step-by-step, very detailed reconstruction of anticipated operator actions in implementing each procedural step. Note taking of data was used to document this process.

Selected procedures were executed in real-time walk-throughs at the culmination of the task analysis - talk-through phase. The main purpose was validation of observations made during the preceding phases and to bring out time critical effects that may not have been noticeable during the non-real-time analysis.

The real-time walk-through observations were non-intrusive (no operator commentary). Unusual effects noticed during the walk-throughs were analyzed during the "post-hoc" evaluation sessions. The HFE consultant and review team personnel participated in the "post-hoc" evaluation sessions to assure completeness and objectivity of the evaluation.

The above process served also to identify any missing displays and controls. Additionally, an inventory of the Control Room instrumentation was used extensively during this review.

C. Operator Interviews

Since Seabrook is not yet an operating plant, operator interviews were, of necessity, conducted differently than if it were operating. The Operation's staff does consist of many senior people with operations experience on other plants and with limited experience on the simulator. To make use of this experience, some of these operators were interviewed during the review process.

These interviews were structured based on formats developed by various human factors groups, modified as needed to take into account the fact that Seabrook is not an operating plant. Questions on training and the use of the simulator were emphasized. The final format was developed jointly by the Control Room review team and the human factors consultant. A copy of this interview form is included as an appendix to this report.

The interviews were conducted by the human factors consultant to assure a reasonable level of independence. The results were used to discover potential HEDs and to assess those potential HEDs previously discovered.

D. Survey of the Control Room Hardware

The survey of the Control Room hardware was conducted on the Seabrook simulator. This simulator is an exact duplicate of the Seabrook Unit 1 MCB and is used extensively in the training of the operators. The layout of the Simulator Room and the environmental aspects (lighting, sound, etc.) duplicate those of the Main Control Room as much as possible.

The survey was performed by a team of engineers, operators, and human factors specialists. The team was trained in both the simulator and classroom in what to look for while examining the Board panel by panel. An agenda for the training session is included as an appendix.

Team members were divided into pairs, usually an operator paired with an engineer or human factors specialist; and different pairs were assigned to different panels. These pairs employed common checklist/rating forms developed by the human factors consultant and YAEC, and made notations of human engineering deficiencies on those forms.

Photographs of each panel were taken for documentation purposes. These were used to document what was reviewed and in the assessment process as required to assess potential human engineering discrepancies.

E. Assessment

The potential human engineering discrepancies have been assessed, and a determination made as to which are significant and should be corrected. The assessment process included an evaluation with respect to the importance of the HED in contributing to operator error; and with respect to the appropriate schedule for modifying the Control Room to rectify the HED.

The review team took the raw data from the Control Room Review and organized it in a logical manner. A thorough assessment was then carried out by the core group mentioned previously. The remainder of the team that participated in the actual review was available on an as-needed basis for assistance in assessing discrepancies in their areas of expertise.

For all discrepancies, an assessment of the consequences was made by the core group. This assessment took into account whether or not the potential operator error was detectable and/or correctable, the system consequences as a result of the error, and the potential for serious system consequences. This assessment was the first step in the classification of HEDs.

These discrepancies were then evaluated for possible correction by the review team. Discrepancies were prioritized according to their potential for operator error by the review team. Emphasis was placed on any significant discrepancies for possible correction. Alternatives such as enhancement, design change, procedure change or no change were considered for each discrepancy. This final report details all discrepancies, the disposition of each discrepancy, and the logic for the disposition.

The cumulative impact of minor HEDs was assessed for each board section by taking all the HEDs for that particular section and looking at their interaction with each other.

For ease in discussion of the potential Human Engineering Discrepancies (HEDs), they have been divided with two sections, Generic and Specific. In the Generic section, the problem is stated, then those examples that appeared on the board are listed. In the Specific section we include those which are not related to any generic problem. A preferred resolution has been developed for each potential HED.

A priority has been assigned to each HED. This priority is a rating of the importance of the potential HED in contributing to operator error and the appropriate schedule for implementing any necessary modification. The Importance and Schedule categories follow here:

Importance

1. Significant potential for uncorrected operator error and risk of serious consequences.

2. Some potential for uncorrected operator error and risk of moderate consequences. No risk of serious consequences.

3. Little or no potential for uncorrected operator error and risk of consequences. Rectification of HED should enhance operator training and satisfaction.

Schedule

A. Before startup, initiate as soon as possible.

B. Before startup, but some further study and engineering will be required.

C. First outage.

D. Indefinite at this time.

E. Will not be done.

F. Verification

Each selected improvement has been verified to insure that it will provide the necessary correction and can be introduced into the Control Room without creating an unacceptable human engineering discrepancy in itself. Such improvements have been coordinated with changes resulting from other programs.

IV. OVERALL BOARD ASSESSMENT

The results of the above efforts are included in Sections V and VI of this report. In it are included the potential HEDs discovered, the selected design improvement for correction if necessary, and a justification for those not corrected.

We found that the general layout and organization of the Seabrook Control Room is excellent; the front panels being benchboards with all displays and controls of engineered safeguard systems located to the far left, the reactor and primary system located to the left center, the turbine generator and secondary system located to the right center, and the electrical system located to the far right. Associated with each of the four main sections is a video alarm system display and contiguous keyboard, as well as some redundant hard-wired alarm and status lights. In the center are four video displays that may be used for monitoring alarms, as well as for call up of other variables, plant diagrams, trend plots, logic trees, and the management of these. Two large video displays to the left and right may be used flexibly.

Back panels generally contain only those controls and displays not needed frequently or in a hurry in emergencies or used in conjunction with front panel displays and controls.

A novel color coding scheme for indicators uses a pink scale background for temperature, light blue for flow, light green for level, and light yellow for pressure. The red/white safety train color coding of components is effective, and is well-presented.

We feel that the board will adapt well to generic labeling and demarcation. Considerable flexibility is anticipated with the use of the Video Alarm System. Altogether, we find that the board is well layed out and designed.

Several items have not been included in this document because they are not yet ready for review. They are:

- Video alarm system, SPDS and associated computer aids to operator.

- Hard-wired annunciators.

- Auditory signals, communications within and outside the Control Room, acoustic noise.

- Radiation Monitoring System.

- Lighting, except to a limited degree.

- Heating, ventilation and air conditioning.

- Control Room access and architecture relative to supervision, storage of emergency equipment, escape, limiting access of unauthorized persons, rest room and eating facilities.

- Storage of operating procedures and keys, tagging, shift turnover and other administrative procedures.

- Remote shutdown panel.

These will be reviewed and included in later supplements to this report.

V. GENERIC HUMAN ENGINEERING DISCREPANCIES

A. Anthropometrics

Some lights, controls and indicators are outside the standard anthropometric bounds.

1. Annunciators

Resolution:

See Item I.D.1.

2. Top row of indicators on all panels.

Resolution:

On the front panels those indicators are presently ammeters. The quantitative values are not important with the exception of Tave and Tref. These are large enough to be seen clearly. Priority 3E.

3. Status lights - lettering is small and the lights are high.

Resolution:

This is a deviation from human factors criteria. An effort has been made to limit the number of words to those necessary and effective. The tiles have been grouped to establish a pattern which will serve the operator as a recognition tool. An identification has been added to the tile layout. If a particular light is out, the operator will approach the board to read it. If he cannot read it directly, he will use the identification matrix to locate it on a hand-held hard copy located at the board. A method will be devised to keep these hard copies available at the board. Priority 3B.

4. Some CRT displays are high on the board.

Resolution:

The data on these CRTs are for the convenience of the operator and consist of auxiliary information that he wishes to have available as an operational aid. All important information appears on other, more centrally located CRTs. The Video Alarm System indications on the CRTs are large enough to be read easily. Priority 3E.

5. Some controls on bottom of sloping section are beyond the reach criteria.

Resolution:

When questioned, operators had no problem with this potential HED. Therefore, no change needs to be made. Priority 3E.

B. Status Lights

In general, all status light panels are confusing in arrangement and wording.

Resolution:

Arrangements and wording are being checked and changes made as necessary. Demarcation is being added. Priority 1B.

C. Demarcation and Labeling

1. An identification of functional groups should be developed for all panels as necessary, using demarcation lines and hierarchical labeling.

Resolution:

This will be done. Priority 1B.

D. Annunciators

1. The 3/16" type on the simulator is too small to read.

Resolution:

Make the type as large as possible but no less than 1/4", consistent with not crowding the edges or compromising the abbreviations used. Priority 2B.

2. The abbreviations are inconsistent.

Resolution:

Develop and use consistent abbreviations. Priority 3B.

3. There is no easily visible tile location matrix.

Resolution:

Develop an easily visible tile location matrix. Priority 3B.

4. Alarm setpoints are not shown on the tiles.

Resolution:

This information will be made available to the operator in readily accessible documents. Priority 3A.

5. The first out priority does not address Safety Injection. There is no indication of the cause of an SI actuation. A first out indication should be developed.

Resolution:

First out indication for SI actuation will be developed. Priority 1B.

6. There is no unique audible signal for first out indication.

Resolution:

A unique audible signal will be developed for first out. Priority 1B.

E. Abbreviations

1. Abbreviations must be made more consistent between board labels, status lights, annunciators and procedures to the extent possible in the Control Room.

Resolution:

The operating staff will develop a list of consistent abbreviations to be used throughout the Control Room where possible. Priority 3B.

F. Labels

1. Tabs on label plates for vertical indicators are fragile. They can easily break when tab is removed to zero the indicator.

Resolution:

Instruct the operator/technician on the proper method of removal. Priority 3A.

2. Labeling is unclear on critical MOVs which have redundant sets of indicating lights.

Examples:

SI injection valves V-77, 102

Resolution:

Labels have been clarified, and operators have been informed as to what the two sets of lights mean. Priority 2A.

3. Labels are unclear and/or confusing and do not provide the information required.

Examples:

Panel A/B, Controllers RH-FCV 606, 607, 618, and 619. Panel A/B, Containment Spray Isolation Valves. Flow arrows on RCP supply should be labeled RCP-1A, RCP-1C. Annunciator panel, RELIEF/SAFETY VALVE OPEN.

Resolution:

The labels will be reviewed to provide the information required. Priority 2A.

G. Indicators

1. It is difficult to read the labels on those indicators low on the vertical section of the control board.

Resolution:

(a) On the MCB, a plastic filler has been placed under the nameplates, changing their orientation to vertical, and making them visible.

(b) Make the same change on the simulator. Priority 3A.

2. There is poor contrast between the red pointers and the pink background for dual temperature indicators.

Resolution:

(a) On the MCB, use a lighter shade of pink for the background. Priority 3B.

(b) On the simulator, leave as is as it is not a major problem. Priority 3E.

3. Technical Specification alarm levels and operating bands are not shown.

Resolution:

Operating plant management will determine what, if any, markings are necessary. These will be shown on the indicators. Priority 2B.

Examples:

LI-4079 (CST level)

LT-2607

H. Mimic

1. Line widths are not right. Some are too large. The line width is not diversified enough. Thinner lines should be used for minor flows.

Resolution:

Although the simulator and the MCB are different (1/4" and 3/8") the main flow mimic on both is ok as is. Auxiliary flow mimic should be approximately 1/2 the size of the main flow mimic. This will be changed. Priority 2B.

2. Color contrast is not good in some areas. Examples are use of black arrows on brown mimic, and use of the same color for different flow paths in a mimic.

Resolution:

We will investigate the problem and develop better contrasts by using both color and width variations. Priority 2B.

3. Paint is chipping off the brass mimic on many of the panels. There is some concern over the durability of the painted brass.

Resolution:

Either another material will be used or the brass will be periodically repainted as needed. Priority 2B.

4. Arrows are missing on various mimic sections.

Resolution:

Add arrows to mimic. Priority 2B.

I. Controllers

1. Auto/manual labels are difficult to see from a standing position. They are small, and tend to fall off easily.

Resolution:

This is a problem with the brand of controller. The operators will be trained to be aware of the problem. The labels will be taped or glued in place. Priority 3B.

2. Some Hagan valve controllers turn left to open, some turn right.

   Examples: RHR Hx outlet valves
   SI accumulator N_2 vent

   Resolution:

   This will be corrected so that the open direction is consistently to the right. Priority 1A.

   Resolution:

3. On manual controllers, push buttons for "increase" and "decrease" are difficult to distinguish from "manual" and "auto".

   Resolution:

   We will investigate changing lens colors or using better labeling. Priority 3B.

4. Hagan controllers do not have valve position lights associated with them. Also, the % open indication is a demand signal, not position feedback.

   Example: HVC 606 (RHR temperature control)

Resolution:

The only time that valve position lights could be helpful is during start up of the systems. The majority of the time there would be two lights lit anyway, as these are modulating valves. Flow indication exists for all these valves.

The procedure will be written to verify that flow exists. The operators will be trained to recognize the situation. Additionally, the operators will be trained to realize that the % open indication is a demand signal, not a position feedback and the nameplate will be changed to indicate DEMAND. Priority 2A.

J. Recorders

1. The design of the Foxboro edgewise recorders does not allow for easy reading of the scale. There is also some delay before the trend indications can be seen.

Resolution:

Train the operators to be aware of this problem. Critical trends can be repeated on a CRT when needed. Priority 3A.

2. The type and size of chart paper is not indicated on the recorders.

Resolution:

Place stickers with this information on the interior of the recorders so they can be seen when recorder is pulled out. Priority 2B.

3. Normal and abnormal ranges are not indicated.

Resolution:

Operating plant management will determine what, if any, markings are necessary. These will be shown on the indicators. Priority 2B.

4. Recorder scales have not been reviewed yet because they were not available. However, some examples seem to deviate from accepted methods.

Resolution:

After installation, all recorder scales will be reviewed for correct correlation with respective indicators. Priority 2B.

5. Unused recorder pens should have no scales.

Resolution:

Scales will be removed. Priority 3B.

K. Lighting

1. There is a glare on indicators, recorders, and CRTs.

Resolution:

A study will be made of the glare problem and the methods that can be used to reduce it. Some of this work can be done now, some must wait until the Control Room is complete. Priority 3C.

L. Controls

1. Trip/reset function is inconsistent.

Resolution:

a. We will investigate the use of push buttons.

b. Make switches consistent with respect to direction of trip and reset.

c. Investigate the use of switch handles that are different from other board switches. Priority 1B.

3. Switch handles are inconsistent with respect to function and type (pistol grip, etc.).

Examples: S, T, and P safeguards actuation and reset switches on Panels A and B front

Oil lift pump switches
RMW-P-16A and 16B
SB-P-171A, B
SF-P-10A, B
Turbine trip push button

Resolution:

We will make them as consistent as possible, consistent with logic and electrical function. Priority 2B.

4. Some switches placed on the rear of the horizontal panel require excessive force to place in pull-to-lock position.

Resolution:

This is overcome by using proper lifting procedure. This operation is not a normal procedure. The switches will wear in as they are operated. No change needs to be made. Priority 3E.

M. Bulbs

1. There is no lamp test function for board indicating lights other than status and annunciator lights.

Resolution:

The watch turnover procedure addresses the condition of lights on the Control Board. The person taking over the watch reviews the board to see the status of the plant. He checks the pumps that are supposed to be running and the valve position. If a light is not on, a new bulb will be inserted. At that time, any burned out lights will be found. Priority 3E.

2. Bulb covers on status lights, lamp test buttons and valve push buttons are difficult to remove. Valves could be moved by accident when changing bulbs on Master Specialty switches.

Resolution:

The operators will be made aware of the problem as a part of their training program and will use appropriate caution when changing bulbs. Priority 2E.

3. Bulb replacement on annunciators and status lights requires stepping on the Control Board.

Resolution:

Purchase special stepladder for bulb replacement. Priority 1A.

N. Master Specialty switches are used for lamp test buttons, channel selector switches, and valve switches without any distinguishing characteristics between switch types.

Resolution:

Devise a method for differentiation, such as a different colored bezel. Priority 2B.

O. Tank level indicators should have "gallons" on scales, as Technical Specifications and procedures call for action based upon gallons.

Resolution:

Tank level should be in units consistent with Technical Specifications and procedures. If % is chosen, then engineering units should also be marked on the indicator scale. Priority 2B.

P. All three-way valves have a problem in that they are always open one way or another, yet use red-green lights to show indication of open direction (green means OPEN here). This is confusing. An example is the letdown heat exchanger valve CSV 170.

Resolution:

Changes will be made to obtain an obvious correspondence between mimic, light, and switch position. An amber light will be used for the abnormal lineup. Priority 1A.

VI. SPECIFIC HUMAN ENGINEERING DISCREPANCIES

A. Panels A and B Front

1. The arrangement of switches and mimic of the safeguards panel on both A and B are confusing, with a lot of mirror imaging used.

   Resolution:

   Develop a layout that addresses the confusion problem. Priority 1A.

2. On Panel B, the present layout of the accumulators (A-C-B-D left to right) is confusing.

   Resolution:

   The recommendation of the Human Factors Review Group is to change the layout to A-B-C-D left to right. This eliminates the problem. Priority 3A.

   However, the decision has been made not to make the change. The justification is that significant layout changes to MCB Section BF have been made to address the confusing arrangement and mimic on Sections AF and BF (HED, Page 25, A.1). The A-C-B-D accumulator layout is acceptable for the following reasons:

   1) The priority is 3A. The Human Factors Review Group agrees there is little or no potential for uncorrected operator error and risk of consequences.

   2) Accumulators are passive devices. There is no chance for uncorrected operator error in the event of an accident as all actions required for injection are taken during startup.

3) The A-C (Train A) B-D (Train B) layout emphasizes the train assignment of the isolation valves.

If accumulators are moved, major separation barrier rework and additional switch and indicator movements will be necessary.

3. RCS wide-range (0-3000) pressure indicators on Panel C/D front are not close enough to RHR and SI controls to give proper feedback.

Resolution:

Add indicator to Panel B left. Priority 1B.

4. Controllers RH-FCV 606, 607, 618, 619 are not labeled properly.

Resolution:

Generic Item I.F.3. The labels will be clarified. Priority 1B.

5. Nitrogen supply valves to containment nitrogen header (containment isolation valves) and accompanying mimic are placed in an inappropriate location.

Resolution:

Place them with the PRT mimic on C front. Priority 2A.

6. The labels on containment spray isolation now indicate 1/2 which is ambiguous. They should indicate that both switches must be actuated.

Resolution:

Clarify the label and the procedure. Generic Item I.F.3. Priority 1B..

7. Feedback to SI reset is poor, with status light going out.

Resolution:

A positive form of feedback has been provided. A status light now goes on for SI reset.

8. Status light panels for Train A and Train B are reversed with respect to the controls and annunciators.

Resolution:

Reverse them to correspond with the panel layout, A-B left to right. Priority 1A..

9. Two status lights say "SI Actuation". One is mislabeled.

Resolution:

The mislabeled light will be labeled correctly. Priority 1A.

10. On status lights, A and B are used for both train and phase designation.

Resolution:

This is a common designation (the Westinghouse philosophy throughout their systems) and is familiar to operators. This will be pointed out in training. Priority 3E.

11. Scale on Containment Building recirculation sump indicator is not easily interpreted (3, 6, 9), instead of (2-4-6) or (5-10-15).

Resolution:

This indicator has been removed from the board, and the information is now available on the computer. The units will be checked to insure they are correct. Priority 1A.

12. The Containment Building spray signal reset controls are crisscrossed.

Resolution:

They will be rearranged. Priority 1A.

13. Train A actuation signal resets P and T should be interchanged.

Resolution:

They will be interchanged. Priority 1A.

14. There is a need for a sensitive containment pressure (scale 0-5 psi) indicator on the front panel to read to one-half PSI as required by emergency operating procedures.

Resolution:

There is presently an indicator on the back panel. This will remain there. A narrow-range indicator will be added to panel BF adjacent to the existing containment pressure indicator. Priority 1B.

15. There is a need for a containment pressure recorder on the front panel to avoid running to panel GR during EO procedure. This should be a wide-range recorder (e.g., 0-60 psig).

Resolution:

Because redundant recorders are required by Regulatory Guide 1.97, one recorder will be added to Section BF, and the existing recorder will be moved from Section GR to Section BF. Priority 1B.

16. There should be a narrow-range indication of containment recirculation sump level. The procedure says to check it.

Resolution:

The need is to check Containment Building level. Because of the design of the sump, sump level is not the best indication of this. Containment Building level is already indicated and recorded. The procedure will be changed to require checking of Containment Building level, not containment sump level. Priority 2A.

17. An RWST level recorder should be on front of Panel B.

Resolution:

Because redundant recorders are required by Regulatory Guide 1.97, two recorders will be added to Section BF. Priority 1A.

18. There is a need to review SI block lights on UL-1, re: MSIVs staying open.

Resolution:

Repositioning of the status lights and special marking now indicates the proper sequence. The procedures and operator training will address the use of the status lights. Priority 1B.

19. There is insufficient alarm or feedback, re: containment radiation for operator at Panel A or B. There is a danger of the alarm being canceled and missing a high radiation signal.

Resolution:

The Radiation Monitoring System, including alarms, will be addressed in a future supplement to this report. Priority 2B.

B. Panel C Front

1. The lights for control switch CS9404 (valve V309) are not installed.

Resolution:

This is a three-way valve. Lights will be installed. Priority 2A.

2. The arrangement and mimic from CS7320 to large arrow could be cleaner. The locations for RCP oil lift pump switches and RMW to RCPs should be swapped for cleaner arrangement.

Resolution:

Arrangement and mimic have been reviewed. A less confusing arrangement has been worked out and will be implemented. Priority 3B.

3. NR PZR level (all 3) should be grouped together and separated from WR level. Wide-range label should say "COLD CALIBRATION".

Resolution:

These changes will be made. Priority 2A.

4. PZR spray line temperature indicators should be revised. They presently are Loop 3-Loop 1, L to R.

Resolution:

They have been changed to 1-3, L-R on the simulator. They will be changed on the MCB. Priority 3A.

5. The RCP seal water supply flow indication and control valves should be closer to RCP controls (now on D front).

Resolution:

This panel has been rearranged. Repositioning of controls and new mimic have clarified the operation. Therefore, these can be left as they are. Priority 3E.

6. The narrow-range scales on seal return recorders should read 0-1 gpm linear to allow proper startup condition at 0.2 gpm. It would be better if both narrow and wide were on the same recorders. Scale range 0-6 is ok on wide range so long as it is linear.

Resolution:

Change the recorders as indicated above. Priority 2B.

7. The flow arrow on RCP supply to spray valve controllers should be labeled RCP-1A, RCP-1C.

Resolution:

The labeling will be changed. Priority 2A.

8. The RCP ammeters have too insensitive a scale to distinguish limits on current. They need narrow range.

Resolution:

Procedures should be reviewed to insure this is necessary. Band the normal range after this is determined during plant startup. If it is determined after startup that a narrow-range indicator is necessary, it will be added. Priority 3C.

9. The RCP flow meter reads in %, and should read in gpm.

Resolution:

All low flow reactor trip setpoints are based on % flow. Therefore, the % flow is correct, and should remain.

10. On the PZR pressure scale, the pointer partially covers the numbers.

Resolution:

Dual indicators force compromises. The operator is not bothered by this. While the indicator is not the best, it is adequate. Priority 3E.

11. PZR level is a narrow-range recorder with a 0-100% scale.

Resolution:

This is not a wide-range scale. The operators will be trained to recognize this. Priority 3E.

12. On RCFV2881, the label says AUTO, but switch has only two positions.

Resolution:

The simulator has the wrong switch. It will be replaced. The MCB has the correct switch. Priority 2A.

C. Panel D Front

1. The CVCS component arrangement and mimic are confusing.

Resolution:

This section has been reviewed and will be rearranged to eliminate the confusion. Priority 1A.

2. Nuclear instrumentation block switches should be demarcated.

Resolution:

Suitable demarcation will be added. Priority 1B.

3. Containment isolation verification difficult if status lamps are not functioning. There is not one panel that has all the containment isolation valves together.

Resolution:

We have investigated the possibility of grouping all together, and have placed all valves not needed in a mimic on B rear.

4. The reactor trip lights have B on the top in Panel D and A on top in Panel A.

Resolution:

Reverse so that A is on top on Panel D also. Priority 1A.

5. There is a need for Rx trip bypass breaker status indication.

Resolution:

Provide such indication. Locate it next to the Rx trip breakers and separate from them. Priority 1B.

6. On thermal regeneration system three white lights on selector switch are not labeled, therefore are not clear.

Resolution:

The lights will be labeled. Priority 1B.
Additionally, this needs further study to see if other controls are needed. Priority 3C.

7. Charging pumps are L to R, B to A instead of A to B.

Resolution:

This was included in the general review of the arrangement of CVCS system. It will be changed L-R, A-B. Priority 1A.

8. Need Tave PAM recorder or Tc and Th on the same recorder to verify Tave decreasing to 557 degrees as required in EO procedure. Need degrees Fahrenheit scale on this recorder.

Resolution:

Make Tave recorder into PAM recorder. Priority 2B.

9. Adjustment of boration-dilution is difficult without inadvertent alteration of count when window is raised; also, decimal point is not indicated; need to specify units (gallons).

Resolution:

This is a continuous operation, with a potential for error. We will either rework window or look for another type of controller. Priority 2C.

10. % delta flux indicators do not show + or - on the scale.

Resolution:

We will add +/- indication. Priority 1A.

11. There is a need for current and historical indication of % delta flux as a function of power and setpoints displayed continuously.

Resolution:

This information can be supplied in several ways, either in the computer or by recorder. This will be studied to see which is more appropriate. Priority 3B.

12. Need a narrow-range (0-100°F) delta T indicator and recorder for natural circulation conditions.

Resolution:

We will add required indicator and recorder. Priority 1A.

13. On the Tracor NR-45 it is impossible to tell which pen is selected by which switch. It is better labeled on the MCB. With the door closed, the scale is obscured by door frame; glass on scale has poor transparency.

Resolution:

The labeling on the simulator will be upgraded. The door will be either rebuilt or removed. Priority 2B.

14. Tracor recorders NR-47 and NR-45 red pens are hard to change.

Resolution:

This is a function of recorder design. Operators will learn to do it correctly. Priority 3E.

15. Correlation is reversed between the selector switches and channels for the delta T bypass selector switches and the Tave/Tref recorder channel select switches.

Resolution:

The nameplates will be re-labled to clarify the correlation and the functional interface with the respective recorders. Priority 1A.

16. Mode switches for boration are 6 positions. It appears that the indicating lights have been removed.

Resolution:

The control switch for the system has indicating lights. This is only a mode switch and does not require lights. This is consistant with the philosophy that mode switches do not have indicating lights. Priority 3E.

17. There is no status indication for motor generator sets, including status of both output breaker and tie breaker.

Resolution:

Add a computer alarm for MG set breakers open. Priority 2B.

18. Should in-out direction of control rod drive joystick be reversed? This should be resolved by a poll of the operators; there is no "right answer".

Resolution:

Poll shows operators divided 50/50 on this question. The joystick will be made push-IN, pull-OUT. Priority 2A.

19. The reactor trip status panel needs regrouping and possible rewording.

Resolution:

The status panels will be reviewed and regrouped. Priority 1B.

20. It could be difficult to see rod position display from the side. The display is large and takes up valuable real estate requiring nuclear flux and power indicators to be moved up on the panel.

Resolution:

This is a vendor-supplied panel. It can be seen, and the operators will learn to use it effectively. The other indicators are readily visible. Priority 3E.

21. The boron dilution alarm is at 1.5 times shutdown count rate. Should there be an interlock or trip in addition?

Resolution:

This is used only in the re-fueling mode. There is an audible count rate monitoring this at all times. The alarm is to notify operator that he is making a mistake. There is no need for any other trip or interlock. Priority 3E.

22. It is hard to check that rod groups are within one step of each other as required in procedures. Cannot see odd numbers on IRPI, must depend upon alarm.

Resolution:

The alarm is there to depend on. There is digital indication that the step signal has been received. No change is needed. Priority 3E.

23. RCP seal injection flow indication is DCBA.

Resolution:

Simulator is ok. The MCB will be changed to ABCD. Priority 2A.

D. Panel E Front

1. The Emergency Feedwater System mimic needs to be reviewed and revised.

Resolution:

Mimic will be added as necessary, and appropriate colors will be used to more effectively indicate flow for this system. Priority 2B.

2. The mimic line for SG feed should come in at center rather than edge.

Resolution:

Move to center. Priority 2A.

3. The bottom row of indicators are mirror imaged and should be made L-R. There are inconsistent relationships between the top two rows of indicators (e.g., flows, levels, pressures). They should be consistently L to R.

Resolution:

These will be changed as noted above. Priority 2B.

4. The T-switch and the MSIV isolation switch are mirror-imaged.

Resolution:

These will be changed to avoid the mirror image. Priority 1A.

5. Steam flow and feed flow indicators are ABCD; SG channel selector switches are 1, 2, 3, 4; all of Channel 1 should be together, all of Channel 2 together, etc., for each steam generator.

Resolution:

The channel selector switches will be revised to match corresponding indicators. Priority 2B.

6. Nameplates are above control switches, below indicators and recorders.

Resolution:

The nameplate is consistently below the indication (lights on switches). This is consistent, and not a problem. No changes will be made. Priority 3E.

7. It is hard to read rates of temperature change and pressure change for cooldown and heatup because of the difficulty in reading edge-wise recorders.

Resolution:

The computer has a program for heatup and cooldown rates. This function will be made available on the CRTs. Priority 2A.

8. No flow indicator exists for startup feed pump.

Resolution:

The need for this is under study. Priority 2D.

9. The main turbine impulse chamber pressure is mislabeled, possibly should be SG reference level.

Resolution:

The indicator will be re-labled to be Program Level. Priority 3A.

10. Train A EFW valve indicating lights should be revised.

Resolution:

They will be changed to either L-R; or open-top, closed-bottom. Priority 1A.

11. SG B and C recorders should be moved one slot over.

Resolution:

They will be moved. Priority 1A.

12. SG PAM recorders should be ABCD, with level and pressure on each, or else get levels and pressures together with Generic labels.

Resolution:

The resolution of this item requires a detailed study of train assignments and power sources. This will take some time to do. Priority 2B.

13. There is a need for DP meter plus/minus 0 - 300 psi to go with PI507 and 508. Need better way to watch SG feed and main steam delta P. Requirement is to hold the programmed ΔP across feed regulator valves. This is especially needed if auto system fails.

Resolution:

One indicator will be added. Priority 2B.

14. Push buttons for feed reg. valve block valves are too close to edge.

Resolution:

These will be guarded. Priority 2B.

15. There are no board indicating lights for steam dump, only status lights.

Resolution:

Existing status lights will be made red and green. Atmospheric steam dump will be distinguished from condenser steam dump by labeling and demarcation. Priority 1A.

16. Status lights for FW flow and bypass valves should be red - green instead of white.

Resolution:

These will be changed to red-green. Priority 1A.

17. There is no narrow range indicated on wide-range SG scale.

Resolution:

The indicator will be banded. Priority 2C.

18. SG feed indicators do not read in gpm, which is asked for in procedures.

Resolution:

The scale is correct, in lbs-mass/hour. The procedure will be changed to lbs-mass/hour. Priority 3A.

19. There is no low-range MFW flow indication for SGs for startup conditions.

Resolution:

The need for this will be assessed during startup. If the automatic level control on the bypass does not work as designed, then an indicator will be considered. Priority 2C.

20. On SG pressure recorders C and D, red pen is FW, blue pen is STM. These should be reversed.

Resolution:

They will be reversed. Priority 3B.

21. The push buttons for the three-element control system for level should be relocated below the corresponding level indicator.

Resolution:

The push buttons will be relocated. Priority 2A.

E. Panel F Front

1. Turbine stop and control valve status lights are lacking for verification of turbine trip.

Resolution:

The stop valves have status lights. The control valves have Closed indication on the meter for use as a backup. Nothing else is needed. Priority 3E.

2. Digital wide-range condenser pressure should be 0 - 30 inches Hg vacuum.

Resolution:

The MCB is correct. The simulator will be changed. Priority 3A.

3. Tave indicator should go over the condenser vacuum indicator to make location consistent with Panel D.

Resolution:

The positions will be reversed on Panel F. Priority 3A.

4. The condenser vacuum pump needs labels to identify multiple red lights.

Resolution:

This is a unique case. Special labeling will be provided. Priority 2A.

5. Reheater steam supply for MSRs - lines of demarcation should be placed around 1 and 2 (West) and 4 and 3 (East).

Resolution:

Demarcation will be added. Priority 1B.

6. Turbine lift pumps A-H lo-press status lights are amber instead of white.

Resolution:

The status lights will be changed to white. Priority 3A.

7. On the turbine control panel, where lettering is in the middle of split window push button, some lettering is difficult to read.

Resolution:

This is an annoyance, but not a major problem. It is a panel supplied by the turbine vendor. The operators will learn to use it. Priority 3E.

8. The lube oil pump should be relabeled to be consistent with procedures (motor suction pump, Step 6.11.3 of ON1031.02).

Resolution:

Procedures and labels will be changed to be consistent. Priority 3B.

9. There is a need to jog MSIV bypass to prevent water hammer.

Resolution:

Throttle capability exists on MCB. Simulator is wrong and will be programmed to provide the throttle capability. Priority 3A.

10. Condenser ABC vacuum and mechanical vacuum pump are in inches of Hg ABS. Procedures are written in inches Hg vacuum. These should be consistent.

Resolution:

These indicators will be changed to inches Hg vacuum. Priority 3A.

11. AC amp indicators should be separated by component (2 groups).

Resolution:

There is room to move heater drain indicators over, have separator between condensate and heater drain pumps. This will be done. Priority 3A.

12. Turbine megawatt has poor scale.

Resolution:

This is a vendor-supplied meter. There are other megawatt indications that the operator can refer to. Leave as is. Priority 3E.

13. Meters with 0,4,8,12, etc., should have 2.6.10, etc., added.

Resolution:

The room is there. The changes will be made. Priority 3A.

14. Turning gear motor indicator needs improving. There is a need to differentiate the small motor from the large motor. Should third light be green, or is this a proper design for a sequencer?

Resolution:

This is a labeling problem. Correct labels will be added. Priority 2A.

15. The turbine speed indicator should have 1800 marked on scale.

Resolution:

This will be marked on scale. Priority 3A.

16. White and blue lights for auto volt adj., man volt adj., gen. field ground exciter field ground are not standard or consistent with other indications.

Resolution:

These switches are used infrequently and under very controlled conditions. The blue light will be changed to white. The white lights will be labeled to reinforce their special meaning. The operator will be trained to recognize this. Priority 3A.

17. The gen. breaker control switch interferes with the indicating light below it.

Resolution:

This is a hardware problem. A longer stem could be used, extending the switch further out from the board. Priority 3B.

18. Some turbine controllers and push buttons 3" from edge.

Resolution:

These are startup control switches, not used at power. However, there is some potential for affecting the T-G if they were inadvertently operated. Provision of a guard of some sort will be investigated. Priority 3D.

19. The operator needs more positive indication of hotwell conditions. Hotwell makeup and reject valve indications are not available.

Recommendation:

Add valve indicator lights. Priority 3C.

20. There is no turbine generator emergency bearing oil pump header pressure indication available in the Control Room.

Resolution:

This pressure and others are available locally. The need for indication in the Control Room will be assessed during the first operating cycle. If changes are needed, they will be made. Priority 3C.

21. Waterbox vacuum breaker valves have one switch to close/open all valves.

Resolution:

These valves are normally operated together. If it is necessary for maintenance, the valves can be individually operated locally. Priority 3E.

22. Main generator transfer voltmeter should indicate high or low. Its scale is poor, should have 5 marks between 5 units. Need range switch?

Resolution:

The voltmeter should not indicate high or low. This is not a consistent reading, as it is related to the relative positions of the adjusting switches. There is no need for extra marks between the units. Operating procedure and training will insure that a null is maintained. Transfer will occur only at the null point. The range switch is not necessary. The auto and manual switches will be adjusted to maintain the null at all times. Priority 3E.

23. Need demarcation on panel between turbine generator lift pump status lights and those for generator exciter field de-excite relay.

Resolution:

Demarcation will be added. Priority 3B.

24. The EBOP (emergency bearing oil pump) switch is not clear when on auto spring return to auto position.

Resolution:

This is clear on MCB. Switch has pointer. The simulator switch will be changed. Priority 3A.

25. On the simulator, the Generator H2 pressure units are in amps. The MCB indicator is missing.

Resolution:

Correct units. Add MCB indicator. Priority 3B.

F. Panel G Front

1. Demarcation/mimic are needed for air system and electrical system.

Resolution:

Demarcation will be added. Priority 1B.

2. Spacing is too close in CW intake area.

Resolution:

Smaller mimic will be used to clean this up. Priority 2B.

3. SW-V-15,16,17,18 mirror-imaged, but mimic is clear. Priority 3E.

Resolution:

No change is required because mimic is clear.

4. Unit 1/2 displays should be distinguishable by demarcation lines or other means, especially for isolated controls.

Resolution:

Demarcation will be added. Priority 1B.

5. Bus 3/4 displays should be distinguishable by demarcation lines.

Resolution:

Demarcation will be added. Priority 3B.

6. Units 1 and 2, Fan 51B control should be white light instead of red. This indicates that control power is available.

Resolution:

The light will be changed. Priority 3A.

7. Circulation water LI-6026, 6038 have improper scale divisions (now is 5 units per 8 feet).

Resolution:

The scale will be changed. Priority 3A.

8. Cooling tower instrumentation is mirror-imaged.

Resolution:

The mirror-imaging will be corrected. Priority 2B.

9. Service water pump discharge valves SW-V-2, V-22, V-29, and V-31 give no direct indication that they are open. That "V-2 CLOSED" and "V-29 CLOSED" status lights go out is not considered to be a satisfactory indication.

Resolution:

Add green/red lights in the mimic for these valves. There is no control from the MCB, but the operator should know the position. Priority 3A.

10. Alarm annunciators for Panel G functions are located on F1 annunciator.

Resolution:

Demarcation will be added as necessary. Priority 3B.

G. H and I Front

1. Train B DG mimic is red on MCB. It should be white if possible.

Resolution:

The B mimic will be changed to white. Priority 3A.

2. Switch colors are not appropriate for DGs; should be red for A, white for B.

Resolution:

MCB is ok. The simulator will be changed. Priority 3A.

3. Nameplates and control switches are not color consistent.

Resolution:

MCB is ok. Simulator nameplates are ok; but switches will be changed. Priority 3A.

4. GE meters not numbered.

Resolution:

They will be numbered. Priority 3A.

5. DG fuel oil storage tank level indicator does not indicate minimum level; scale should be in gallons.

Resolution:

The scale will be changed. Priority 3A. The minimum level will be determined and marked. Priority 2B.

6. The Pointer obscures numbers on circular meters. Red pointers might improve the situation.

Resolution:

They can read easily. They will be left as is. Priority 3E.

7. DG manual and auto volt and speed adjust increase to left, decrease to right.

Resolution:

They will be changed to increase right, decrease left. Priority 1A.

8. All meters fail at zero (or 1st graduation), not below 0.

Resolution:

This is acceptable. Operator training will cover the fail position for indicators. Priority 3E.

9. Indicating lights above 345 kV breakers do not follow standard convention. Blue light should be above red/green, not in line. Also, if red and green lights indicate control power, why is another light needed?

Resolution:

The blue lights are all right as is, in line. They do not detract from the operators understanding of the system. The blue lights indicate that the MCB has control of the breaker. The red/green lights indicate position of the breaker. The blue lights are necessary, and the operator will be trained in their use. Priority 3E.

10. All disconnect switches should read open/close instead of trip/close.

Resolution:

The MCB is ok. The simulator will be changed. Priority 3A.

11. The switch handle of the DG manual volt adj. partially obscures indicating lights of DG gov. mode selector.

Resolution:

This is no problem and will be left as is. Priority 3E.

12. There are no pointers (only targets) on some GE switches.

Resolution:

The target provides sufficient indication of switch position. Priority 3E.

13. The pointer on the DG main volt adjust is not painted white, and there is no pointer on shaft.

Resolution:

Paint white mark on the switch. Priority 3A.

14. VS-9965, SNS-9880, SNS-4737-1 and SNS-9736-1 switch handles hide pointer.

Resolution:

Paint white mark on switch handles. Priority 3A.

15. Both DG emergency start and emergency stop buttons should be more uniquely identified.

Resolution:

Demarcation will be added. Priority 1B.

16. There is a need for unique identification labels for Buses E5 and E6 indicators to identify them as emergency buses.

Resolution:

Unique labels will be added. Priority 2A.

17. There are no "diesel trouble" or general status lights on VAS. If there is trouble, the "ready for auto start" light goes off. Should have a "DG not available" light which comes on.

Resolution:

This status light will be added. Priority 1A.

18. Annunciator Panels UA 54 and 55, 480 volt Buses 51, 52, 53 and Buses 61, 62, 63, 64 do not inform the operator which bus is low.

Resolution:

Two voltmeters with selector switches will be added, one for each train. These will provide indication of bus voltages. Priority 3B.

19. Emergency DGs do not have transfer voltmeters. There have been instances where operator did not know if the regulator was following incoming voltage or not.

Resolution:

Indication is available. Better labeling will be added, and the operator will be trained on the operation of the system. Priority 3A.

20. The DG 1A governor mode select should be auto/manual, not droop/isochronous.

Resolution:

This will be changed. Priority 3A.

21. Many labels are missing on Section G of MCB. They must be added.

Resolution:

Labels will be added. Priority 3A.

H. Panel A and B Rear

1. There is a need for demarcation between BTRS, SG blowdown, containment isolation valves, and boron measuring system switches.

Resolution:

Demarcation will be added. Priority 2A.

2. Containment isolation valve positions are inconsistent, re: train correspondence to physical inside-outside of containment.

Resolution:

The operator looks to insure that all are closed (green). If one does not shut, then he shuts it. It does not matter if it is inside or outside, the operator response is the same. Therefore, this can be left as is. Priority 3E.

3. It is hard to get visual verification of containment isolation, have to read labels. Could put demarcation lines around set of containment isolation valves which need to be checked closed.

Resolution:

Demarcation will be added. Priority 2B.

4. There is no flow mimic except safety system leak test section; check consistency with main panel spent fuel pool, etc.

Resolution:

Mimic should be added to the BTRS, SG Blowdown, and Spent Fuel Pool sections. Priority 3B.

5. SG indicators are not in line with blowdown control; they should be moved left.

Resolution:

They will be moved. Priority 2A.

6. There is no label on temperature of spent fuel pool.

Resolution:

The MCB is ok. A label will be added to the simulator. Priority 3A.

7. There are no escutcheons on SFP switches 10A, 10B.

Resolution:

The MCB is ok. The simulator will be fixed.

8. The mimic in SI test panel is confusing.

Resolution:

Mimic will be changed to relieve confusion. Priority 2A.

9. The accumulator symbol is upside down, but if it is turned around it would read from wrong side.

Resolution:

This is not a problem on the MCB. The simulator will be changed. Priority 3A.

10. No accumulator levels are available from back panel.

Resolution:

These are not needed. Indicators are available on the front panel. At present, it appears the required evolution can be accomplished using the front panel indicators.

I. Panel C Rear

1. EAH-DP-29A has wrong control-display correspondence (open left, auto right).

Resolution:

This will be corrected. Priority 3A.

2. There is an odd-sized nameplate on cooling tower switchgear.

Resolution:

There is no room for a larger size. It is legible as is. Priority 3E.

3. Should inches WC be indicated on meter rather than H_2O?

Resolution:

The procedure calls for indication to be inches WC. Priority 3E.

4. Four containment and Control Room ventilation isolation reset switches should be uniquely identified.

Resolution:

These will be demarcated. Priority 1A.

5. Purge vent has no lights.

Resolution:

This is a mode switch only. The control switch has indicating lights. The mode switch does not need them. Priority 3E.

6. FN 2A,B,C,D switches not color coded or labeled to show trains.

Resolution:

They do not need to be. Priority 3E.

7. Demarcation and labeling need to be addressed.

Resolution:

These will be addressed during generic demarcation and labeling effort. Priority 2B.

J. Panel G Rear

1. Mimic is not needed, but demarcation and generic labels are required.

Resolution:

Demarcation and labels will be added. Priority 1B.

2. The new MSIV test panel needs to be checked when installed.

Resolution:

This will be checked when it is installed. Priority 2D.

3. The vibration monitor lights are hard to change.

Resolution:

I&C will be trained to do it. Priority 3E.

4. The switches for emergency trip are not protected from inadvertent operation.

Resolution:

The new MSIV panel will be checked to see if this is still a problem. Priority 2D.

K. Panel H and I Rear

1. The turbine eccentricity recorder is located low on the panel.

Resolution:

Infrequent use makes this acceptable. The computer is available to provide information. Priority 3E.

2. There is no indication of what the white lights tell you for the extraction steam valve test or the FW isolation valve test. In one case it means the valve is closed. In the other it means the valve is 90 % open.

Resolution:

The white light means only that the test has been successful. Procedures will be clarified to say this. No change is necessary. Priority 3E.

3. It is possible for turbine supervisory and conductivity recorders to print over each other.

Resolution:

This is a common problem with this type of recorder. The information is available from other sources. Priority 3E.

4. The new fire panel needs review.

Resolution:

The panel will be reviewed when it is available. Priority 2D.

5. SG recirculation and drain pump controls should be located on FF1 or BR panel near SG blowdown system.

Resolution:

These controls will be moved to BR. Priority 3B.

6. Six vital bus voltage indications are desirable. Only alarms exist now.

Resolution:

These indications will be put on the computer with an analog indication on the CRT. Priority 3B.

7. Turbine supervisory or equivalent computer display should be more accessible to operator on startup on front of panel. Numbering scheme seems poor. How much can be done on CRT display, and is CRT trending better for this purpose? RPM does not agree with RPM meter on turbine control panel. Cannot read vibration with sufficient accuracy. Turbine supervisory needs general review.

Resolution:

This review will be done after plant startup. Any required changes will be made later. Priority 3C.

8. "Core monitor" should be relabeled to be other than "core".

Resolution:

This is familiar to operator, leave as is. Priority 3E.

9. Bus ground meters, cond. recorder, turbine supervisory recorder are not identified by labels.

Resolution:

Labels will be added. Priority 3A.

10. Conductivity colors need to be marked with index on the recorder window.

Resolution:

This will be done. Priority 3A.

11. Labels missing for DC bus, vital and non-vital.

Resolution:

Labels will be added. Priority 3A.

12. Recorder on IR specifies "shell"; the procedure calls for "metal temperature".

Resolution:

The procedure will be changed. Priority 3A.

APPENDIX A

SURVEY TEAM MEMBERSHIP AND QUALIFICATIONS

Survey Team Members

E. A. Sawyer - Team Leader

Yankee Atomic Electric Company
Provides Project Management experience

W. G. Alcusky - I&C Engineer

Yankee Atomic Electric Company
Provides I&C and Human Factors experience

A. Miller - I&C Engineer

Yankee Atomic Electric Company
Provides I&C and Human Factors experience

J. L. Peterson - Shift Superintendent

Seabrook Station Staff
Provides Operations experience

M. J. DeBay - Unit Shift Supervisor

Seabrook Station Staff
Provides Operations experience

M. R. Breault - Unit Shift Supervisor

Seabrook Station Staff
Provides Operations experience

S. F. Urbanowski - Electrical Engineer

Yankee Atomic Electric Company
Provides Electrical Engineering experience

P. L. Anderson - Systems Engineer

Yankee Atomic Electric Company
Provides Systems Engineering experience

T. B. Sheridan, SCD - Human Factors Consultant

Thomas B. Sheridan Associates
Provides Human Factors Engineering experience

D. D. Lanning, PhD - Human Factors Consultant

Thomas B. Sheridan Associates
Provides Human Factors Engineering and Operations experience

M. M. Danchak, PhD - Human Factors Consultant

Thomas B. Sheridan Associates
Provides Human Factors Engineering and Computer Technology experience

Notes:

1. Resumes for Sheridan, Lanning and Danchak are attached here.

2. Various other operators and engineers were available and were used during the review process.

Summary Resume of Thomas B. Sheridan

Thomas B. Sheridan was born in Cincinnati, Ohio, Dec. 23, 1929. He attended Purdue University (B.S. 1951) and, after two years in military service (Aeromedical Laboratory, Wright Patterson Air Force Base, Ohio) attended the University of California, Los Angeles (M.S. 1954) and M.I.T. (Sc.D. 1959). His program at M.I.T. was interdependental between systems engineering and psychology, with one year spent in cross-registration at Harvard University.

For most of his career, Dr. Sheridan has remained at M.I.T., where until recently he was Professor of Mechanical Engineering and is now Professor of Engineering and Applied Psychology. He heads the Man-Machine Systems Laboratory and teaches both graduate and undergraduate subjects in Man-Machine Systems. He is a Faculty Associate of the M.I.T. Science, Technology and Society Program. He helped develop a new interdepartmental graduate degree program in Technology and Policy, and has taught the core seminars for that program. He has also taught control, design and other engineering subjects.

He has served as visiting faculty member at the University of California, Berkeley, Stanford University, and the Technical University of Delft, Netherlands.

Dr. Sheridan's research has been on mathematical models of human operator and socio-economic systems, on man-computer interaction in piloting aircraft and in supervising undersea and industrial robotic systems, and on computer graphic technology for information searching and group decision-making. He is author, with W. R. Ferrell, of Man-Machine Systems: Information, Control and Decision Models of Human Performance, M.I.T. Press, 1974, 1981 (published in Russian, 1980) and co-editor of a 1976 Plenum Press book, Monitoring Behavior and Supervisory Control.

He has been active in the Institute of Electrical and Electronics Engineers, was formerly editor of the IEEE Transactions on Man-Machine Systems, is past president of the IEEE Systems Man and Cybernetics Society, served as Chairman of the IEEE Committee on Technology Forecasting and Assessment and was chairman of the 1981 IEEE Workshop on Human Factors in Nuclear Safety. He is also a Fellow of the Human Factors Society, and in 1977 received their Paul M. Fitts Award for contributions to education. He is Associate Editor of Automatica and on the Editorial Advisory Board of Computer Aided Design.

Dr. Sheridan has served on the Accident Prevention and Injury Control Study Sections of the National Institutes of Health, the NASA Life Sciences Advisory Committee, the NSF Automation Research Council, the NASA Study group on Robotics, the U.S. Congress OTA Task Force on Appropriate Technology, and the NSF Advisory Committee on Applied Physical, Mathematical and Biological Sciences. He is a member of the Committee on Human Factors and the Ad Hoc Committee on Aircrew-Vehicle Interaction, both of the National Research Council.

His industrial consulting activities have included: The General Motors Corp. (auto safety); General Electric Co. (telemanipulators); C.S. Draper Laboratory (design of astronaut interface for Apollo guidance system, industrial robots); Biodynamics, Inc. (biomedical and human factors); Public Broadcast Service (TV audience feedback); National Bureau of Standards (industrial robots); Group Dialog Systems, Inc. (group meeting and decision technology); Northrop Aircraft (pilot workload); Babcock and Wilcox Co. (industrial instrumentation); Lockheed, General Physics, American Electric Power, Consumer's Power, Gibbs and Hill, Virginia Electric Power, General Public Utilities, Stone and Webster, the BWR Owners' Group, Brookhaven National Laboratory and Electric Power Research Institute (man-machine aspects of nuclear plant safety).

Dr. Sheridan is married and has four children.

David D. Lanning (Ph.D. 1963, M.I.T.)

Professor Lanning's fields of interest are the areas of Applied Reactor Nuclear Engineering, Reactor Operation and Safety. He worked at the MIT Reactor in the areas of teaching, research, and reactor operation from 1957 to 1965, and returned to MIT in 1969. At present, he is the Graduate Admissions Officer for the Nuclear Engineering Department as well as continuing his teaching and research. He was in charge of the, now completed, core modification design and installation for the MIT Reactor. He also worked at the research laboratories in Richland, Washington from 1951 to 1957 and from 1965 to 1969. In the latter period, he worked for Battelle-Northwest as a manager of the Reactor Neutronics Section which included the utilization and operation of the High Temperature Lattice Testing Reactor (HTLTR) and the utilization of the Physical Constants Testing Reactor (PCTR). He currently teaches a course in "Reactor Operations" and a course in "Nuclear Power Reactors." His most recent sponsored research and consulting activities have been in the area of power reactor and research reactor core design, transient analysis, control system studies and safety assessments.

Recent Specific Consulting

1. Member of the Safety Audit Committee for the Northern States Power Company Monticello Nuclear Generating Plant (BWR).

2. Member of certain Design Review Boards for the Stone & Webster Engineering Corporation.

3. Consultant for Argonne National Laboratory working on utiliation of low enriched uranium for research and test reactor fuels.

4. Review of Reactor Safety Related Information for the Boston Edison Company.

5. Member of the General Public Utilities Ad Hoc Committee to review the Man-Machine Interface and Operator Training. (TMI-2 Review)

6. Consultant to the BWR Owners Group for Generic Control Room Reviews.

7. Coordinator of an independent consulting group to assist Boston Edison in Training for Core Damage Recognition and Mitigation.

VITA

MICHAEL M. DANCHAK

Office

The Hartford Graduate Center
Computer and Information Science
275 Windsor Street
Hartford, Connecticut 06120
(203)549-3600

Residence

3 Stevens Place
Rocky Hill, Connecticut 06067
(203)529-7769

EMPLOYMENT SYNOPSIS

7/78 - Present	DIRECTOR OF STUDIES Computer and Information Science The Hartford Graduate Center Hartford, Connecticut
7/74 - 7/78	SUPERVISOR - DISPLAY SYSTEMS Instrumentation and Control Engineering Nuclear Power System Combustion Engineering, Incorporated Windsor, Connecticut
9/69 - 7/74	GRADUATE STUDENT Rensselaer Polytechnic Institute Troy, New York
6/65 - 9/69	COMMISSIONED OFFICER United States Marine Corps

EDUCATION

1974	DOCTOR OF PHILOSOPHY, Nuclear Engineering Rensselaer Polytechnic Institute Troy, New York
1972	MASTER OF SCIENCE, Nuclear Engineering Rensselaer Polytechnic Institute Troy, New York
1965	BACHELOR OF SCIENCE IN ENGINEERING, Aerospace and Mechanical Sciences Princeton University Princeton, New Jersey

PERSONAL DATA

Date of Birth: March 28, 1944 Social Security: 200-34-8514
Place of Birth: Coaldale, Pennsylvania Marital Status: Married
Professional Affiliations:
Institute for Electrical and Electronic Engineers
The Human Factors Society
Instrument Society of America
Association for Computing Machinery
Society for Information Display

RECOGNITION

Listed in Who's Who in the East
Atomic Energy Commission Traineeship, 1972 - 1974
National Defense Education Act Traineeship, 1969 - 1972
Elected to Tau Beta Pi, 1970
Naval Reserve Officer Training Course Scholarship, 1961 - 1965

EMPLOYMENT HIGHLIGHTS

1978 - Present The Hartford Graduate Center

Involved with curriculum development and management as well as teaching courses on computer graphics, data structures, man-computer interactions and related areas in the graduate program. Established a computer graphics laboratory that includes a color display system and use the laboratory in ongoing education and research. Primary interests include color graphics and man-machine interactions.

7/74 - 7/78 Combustion Engineering, Incorporated

Primary design responsibility for the computer generated color display system used in advanced power plant control rooms and the attendant human factors aspects. Performed extensive evaluations of available display and computing equipment, devised and tested new display techniques, established procedures for designing display pages and served as a resource for all human factors concerns.

1972 - 1974 Rensselaer Polytechnic Institute

Designed and implemented an interactive computer graphics system for use in nuclear research as part of the doctoral dissertation requirements. This included all hardware, interfacing, software and human factors considerations. Was also a teaching assistant in both undergraduate and graduate courses and a part-time programmer for the New York State Radiological Health Laboratory.

Thesis: The Assessment and Modificaiton of Neutron Cross Sections Via Interactive Graphics.

1969 - 1974 Rensselaer Polytechnic Institute

Developed a mathematical model to predict the re-entrant hole effects in three-dimensional pulsed neutron assemblies, qualified for a Senior Operator License on the RPI Critical Facility (research reactor) and served as a teaching assistant in a special program for disadvantaged students.

Thesis: The Re-entrant Hole Effect in Pulsed Neutron Assemblies.

1965 - 1969 United States Marine Corps

Was initially responsible for the day-to-day operation and training of the first tactical unit armed with the REDEYE Missile. Later assigned as Officer-in-Charge of the school which trained Marine Corps personnel in the use of the REDEYE.

RECENT PROFESSIONAL ACTIVITIES

Reviewer of human factors related papers for Nuclear Safety, 1978.

Invited participant, Man-Machine Interface Forum sponsored by Foxboro Corporation, June 10, 1978.

Member of the Implementation Subgroup, Association for Computing Machinery Special Interest Group for Graphics (SIGGRAPH) CORE System.

Consultant to the Idaho National Engineering Laboratory on computer display design for nuclear power plant control.

Received a research contract from Idaho National Engineering Laboratory to study display of multivariate data on Cathode Ray Tubes (1980).

Participated in a research contract to study the role of the operator in Nuclear Power Operations with RPI faculty, funded by Oak Ridge National Laboratory (1980).

Received a research contract from INEL to study the static and dynamic design considerations of Process Control Alarm displays (1981).

PUBLICATION AND PAPERS

"The Rensselaer Interactive Graphics Analysis System," Transactions of the American Nuclear Society, June, 1974, 18, 159.

"A Simple Device Using Capacitance Switches for Data Entry in Man-Machine Systems," Nuclear Technology, September, 1974, 23, 337.

"Utilization of Interactive Graphics and Continuous Slowing Down Theory," Transactions of the American Nuclear Society, October, 1974, 19, 175.

"Effective CRT Display Creation for Power Plant Applications," Instrumentation in the Power Industry, 1976, 19, 87.

"CRT Displays for Power Plants," Instrumentation Technology, October, 1976, 23, 29.

"The Man-Process Interface Using Computer Generated CRT Displays," Instrumentation in the Power Industry, 1977, 20, 55.

"Alphanumeric Displays for the Man-Process Interface," Advances in Instrumentation, 1977, 32, Part 1, 197.

"The Content of Process Control Alarm Displays," Advances in Instrumentation, 1980, 35, 101.

"Techniques for Displaying Multivariate Data on Cathode Ray Tubes with Applications to Nuclear Process Control," NUREG/CR-1994, April, 1981.

"The Human Factors of CRT Displays for Nuclear Power Plant Control," in Advances in Nuclear Science and Technology, (Lewis and Becker, ed.), 1981, (to be published).

APPENDIX B

SURVEY TEAM TRAINING

AGENDA FOR AUGUST 1 AND 2 BRIEFINGS
RE: CONTROL ROOM REVIEW PLAN AND METHOD

August 1, AM

1) Brief review NRC post-TMI Human Factor programs.
(Control Room Review 0700 and 0801, SPDS 0835, Tech. Support Center, Emergency Shutdown, Emergency Procedures, Probabilistic Risk Analysis)

2) 0700 Proposed plan - what we cannot do at Seabrook.

3) Overview of our plan and how it differs from 0700.

4) Schedule and participants

5) Supporting documents (inputs)
(P&IE diagrams, abbreviations list, inventory of displays and controls, 0700)

6) Forms to be filled out (outputs)
(Survey Checklist, Interview Forms, Procedures Talk/Walkthrough Forms, Charts of Control Panels)

August 1, PM

7) Brief introduction to Human Factors

a) What is it?
b) Who does it?
c) How well does it work?

questions and discussion as per interest of group

August 2, AM

8) Detailed discussion of Control Room Survey

a) General approach and objectives
b) Use of checklist - go through items one by one in front of control panels, find examples
c) Use of diagrams, charts of control panels, abbreviation list
d) Photographic recording
e) Secondary reference to 0700.
f) Assignment of 2-man teams to panels.

August 2, PM

9) Detailed discussion of Operator interviews

a) General approach and objectives
b) Use of forms
c) Assignment of 2-man teams to Operators

10) Detailed discussion of talk/walkthroughs

a) General approach and objectives
b) Choice of procedures
c) Use of forms - meaning of columns relative to 0700 recommendations
d) Construction of task analysis and verification of what is available with what is required
e) Real-time walkthrough and video recording

11) Special presentation/demonstration of alarm system - to be scheduled whenever appropriate

12) Plan for subsequent talk/walkthroughs

13) Computation of data, consensus on discrepancies, scheduling, and preparation of report

APPENDIX C

OPERATOR INTERVIEW FORM

Pat Lydon.

I OPERATOR INTERVIEW

DISCUSSION

The purpose of the Operator Interview is to obtain direct operator and instructor judgment to aid in identifying potential deficiencies in the control room layout or design or in operating procedures that may result in confusion (mental activities), difficulty (manual activities) or distraction (the environment). Though only simulator experience on Seabrook is available, we nevertheless feel that such opinions provide valuable suggestions to the survey team.

Using the attached questionnaire, operators and instructors are asked to respond in writing based on their previous operational experience and knowledge of control rooms in general and their knowledge of the Seabrook control room and procedures in particular. The written responses will be reviewed by a survey team member during the oral interview and possibly augmented by spontaneous replies. If additional space is needed, the attached Comment Form is to be used.

The interviews should be conducted by survey team members with background or experience in operations, engineering or human factors with a position conducive to a free flow of information. It is expected that the oral interview will take one to two hours for each operator with the entire interview taking about one day.

Following the interviews, the survey team will consolidate the information obtained and analyze it to help identify specific areas of concern.

I OPERATOR INTERVIEW

INTRODUCTION TO QUESTIONNAIRE

License Held SRO Years Operational Experience 14 PWR

Education/Degrees B.S. STA qualified

Age 32 Sex M Height 6'2" Weight 189

In response to a post-TMI NRC requirement, PSNH, along with other utilities, is conducting a control room review to identify and correct design deficiencies in the operator-control room interface to minimize the potential for human error. This review is performed by a survey team composed of PSNH and YAEC representatives and some human factors consultants.

You are asked to complete the attached questionnaire basing your responses on your general operational experience and knowledge of what the Seabrook control room is or will be. You may complete this questionnaire anywhere, but please do so without discussing your detailed responses with other operators completing this survey. If additional space is needed, the attached Comment Form is to be used.

Following completion, a survey team representative will review your responses with you. Upon completion of all interviews, the survey team will consolidate the information obtained and apply it in their evaluation of the control room for compliance with human factor engineering principles.

This survey provides you with a valuable opportunity for applying your knowledge and experience toward insuring the best control room design. Your honest and forthright opinions are not only welcomed, but needed.

I OPERATOR INTERVIEW

QUESTIONNAIRE

A What do you consider will be the most difficult, confusing or unreliable system (or component) to operate and why?

In general the Engineered Safety Features is the most confusing. I do think its reliable. Confusing due to multiple setpoints "T" "P" for a situation.

B What do you consider will be the most difficult or most confusing procedure to perform and why?

Have not yet reviewed any other than electrical & turbine systems which are ok.

C What do you consider will be the most difficult or most confusing panel to operate and why?

Engineered Safeguards → seems to be quite densely packed.

D Based on your operational experience, does the Seabrook control room lack any controls or displays needed for response to normal or emergency situations?

Could be very helpful to have an X-Y plotter with horizontal trend for normal operations & may be emergencies.

E Are any important indicators out of visual accessability during normal or emergency operation?

I believe we have shifted them all to front panned.

F Which controls are designed, positioned or labeled in a manner that increases the risk of inadvertent operation?

Resets & trips for ECCS

G What displays do you feel are unnecessary, provide unimportant information or needlessly clutter the control panels?

NA.

I OPERATOR INTERVIEW

QUESTIONNAIRE

H Which controls may be difficult to operate and why?

CVCS – when positive displacement pump is running – due to configuration of flow control & pressure control for RCP seals.

I Which recorders or indicators may be difficult or confusing to read and why?

Fixed recorders.

Add ± 100 Panel ACMS (only most important)

J Do you anticipate having any problems locating or using procedures or operational instructions and why?

No – all procedures will be on CRT's (pushbutton) and hard copy.

K What changes would you recommend (or not recommend) in:

K1 planned shift coverage or turnover policies

4 AO's (1 ACRO)
2 CRO's
1 SRO (SCRO)
1 SRO Unit-SS. ← per unit
1 SRO Station S.S.

K2 planned or ongoing training

Six section rotation ⇒ train every 6th week.

K3 color coding

Yes – standard

K4 control room access

Limited to very few (only those with business.)

K5 control panel layout or access

Best of one seen.

I OPERATOR INTERVIEW

QUESTIONNAIRE

K6 communication systems

We have the best line sent.

K7 heating or ventilation

Standard

K8 lighting

Non glare

K9 special test equipment

For Ao's & what is necessary for surv tests.

K10 maintenance or surveillance testing plans

Regularly scheduled ⇒ with off shift

K11 data recording and log entry plans

① Extensive use of computer
② Clear & concise written logs for CRO
③ Journal for SCRO & U.S.S.

K12 information flow

Ao → Ro - SCRO - U.S.S. ⇒ S.S.

K13 furniture, equipment or workspace

Comfortable - clear

I OPERATOR INTERVIEW

QUESTIONNAIRE

L With regard to the video alarm system:

L1 Are CRT displays:

organized into a logical set that is meaningful to the operator

still working on this

designed with a format appropriate to their use

yes

updated at a rate suitable for the operator

yes

that use charts designed with the appropriate technique based on data and operator use

working on this

L2 Does documentation exist for each display page

working - but should in the end.

L3 Does the documentation specify:

the purpose of each page yes

the content of each page yes

the interrelationships between pages

yes

M other?

I OPERATOR INTERVIEW

QUESTIONNAIRE

N General Comments:

I have not had the opportunity to learn all the systems, therefore there may be less confusion with the ECCS than at present.

Also it has been ~2 years since I tested the simulator & at that time there was no numbers or labeling. At that time we (the S.S.) did make recommendations as to the layout of some controls. Later a special group reviewed the control board for proper labeling and bus layouts. Again recommendations were made. PSNH has been excellent about making these changes.

In general — PSNH have been better and more concerned about running a commercial nuclear plant than any I have either heard of or been exposed to in previous jobs.

Pat Taylor

APPENDIX D

CONTROL ROOM SURVEY CHECKLIST

Terry + Mike completed Checklist

III CONTROL ROOM REVIEW

A+B
Panel FRONT

A PANEL LAYOUT and DESIGN

A1 For control panels:

A1.1 does the design generally meet measurement standards per the attached anthropometric diagrams (complete and attach) 4 (3) 2 1 0

Based on NUREG 0700

A1.2 have sharp cormers and edges been eliminated? 4 3 2 1 0

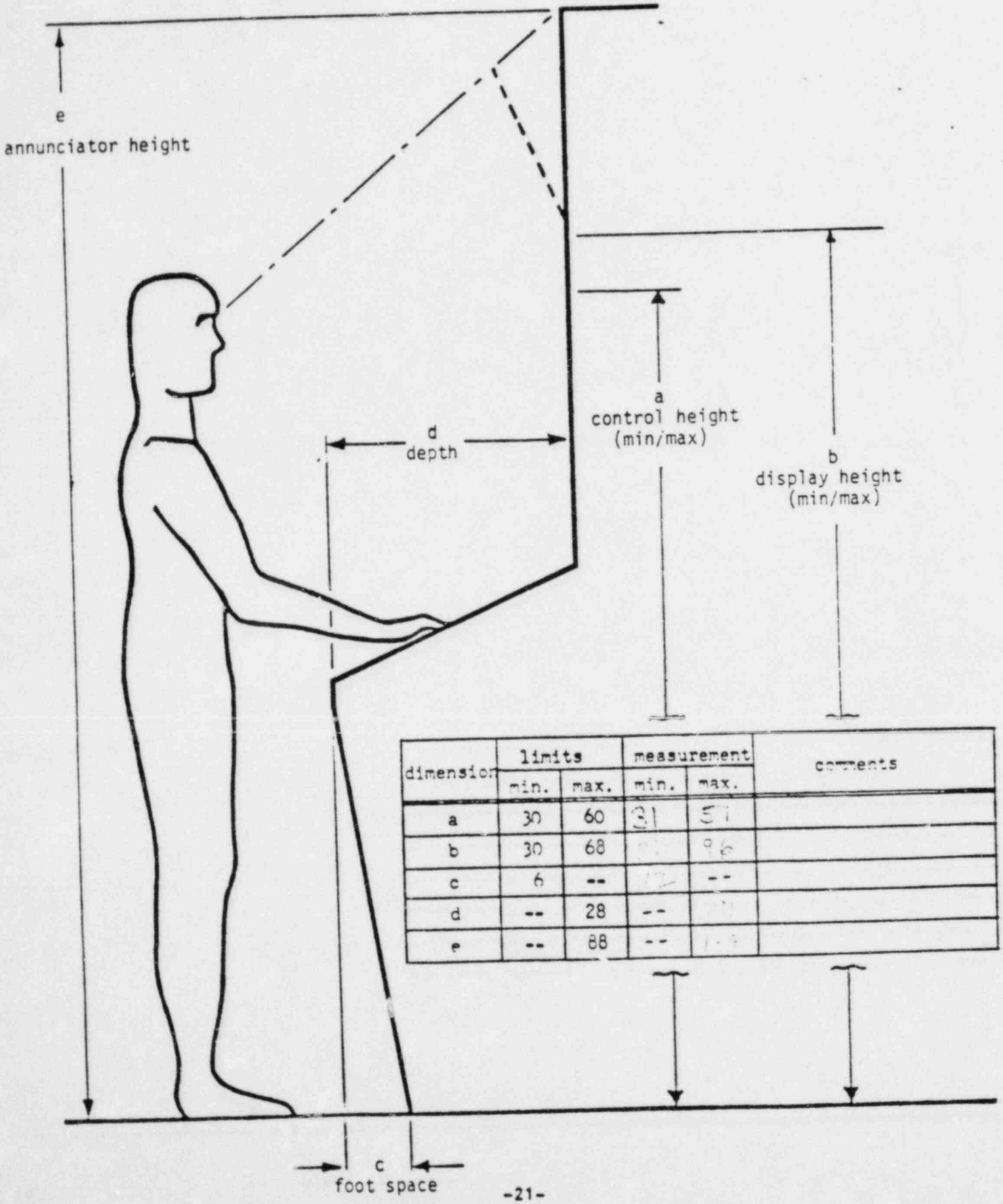
NEED TO AT
FACE OF SITE

A2 Are lines of demarcation, mimics or other graphic displays:

A PANEL LAYOUT and DESIGN (Continued)

(A1.1) Anthropometric Diagram

BENCHBOARD MEASUREMENT
PANEL _____



dimension	limits		measurement		comments
	min.	max.	min.	max.	
a	30	60	31	57	
b	30	68		96	
c	6	--		--	
d	--	28	--		
e	--	88	--		

III CONTROL ROOM REVIEW

Panel _____

A PANEL LAYOUT and DESIGN (Continued)

A2.1	used to group similar display or control functions within system or component groupings	4 3 2 1 0
A2.2	used to distinguish between primary and secondary flow paths	4 3 2 1 0
A2.3	visually distinctive between each other and panel/background	4 3 2 1 0
A2.4	used to provide rapid visual verification of containment isolation	4 3 2 1 0
A2.5	permanent, easy to clean up and maintain	4 3 2 1 0
A2.6	laid-out so that flow paths and arrangements are orderly and easily recognized	4 3 2 1 0
A2.7	identical in layout for repetitive groupings of components	4 3 2 1 0
A2.8	clearly marked with arrows to show direction of "flow"	4 3 2 1 0

III CONTROL ROOM REVIEW

Panel _____

A PANEL LAYOUT and DESIGN (Continued)

A2.9 Flow mimic lines identified with starting and end points — 4 3 2 (1) 0

A2.10 used to integrate switches, pumps, manual and remotely-operated valves, isolation paths, etc. — 4 3 2 1 0

NO manual valves are indicated

A2.11 consistent in the application of symbols for pumps, valves and other process elements — 4 3 2 (1) 0

A3 For controls and displays:

A3.1 are they generally grouped by system (with identical layout for repetitive groups) — 4 3 2 1 0

Unit has entire safety System integrity

A3.2 is ordering for components of similar function consistently from left-to-right or top-to-bottom — 4 3 2 1 0

Do not change Left-To-Right

A3.3 are groupings arranged in functional or sequencial relationships — 4 3 2 1 0

A3.4 when strings (6 or more) or matrices (greater than 4x4) of components of similar or common function are installed, are they visually distinguishable by lines-of-demarcation, hierarchical labeling, color contrast, spacing, shape, etc. — 4 3 2 1 0

Panel only [illegible] of annunciators

III CONTROL ROOM REVIEW

Panel _____

A PANEL LAYOUT and DESIGN (Continued)

A3.5 are coding methods (color, knob type, control type, display type) consistently applied — 4 3 2 1 0

A3.6 are they generally located in zone "a" or "b" on the anthropometric diagram (see A1.1) — 4 3 2 1 0

A3.7 are control components located within an arms reach of feedback indications? — 4 3 2 1 0

A4 For color use:

A4.1 is use of colors consistently applied for alarm prioritization, indicating lights, labels, lines-of-demarcation, legend plates, graphic displays, indicating devices, tags, etc. (Complete list on next page) — 4 3 2 1 0

A4.2 when there is a possible dual meaning for colors, is there an additional indication for visual distinction? — 4 3 2 1 0

A5 Are labels, legend plates and escutcheons:

A5.1 used to identify system or component — 4 3 2 1 0

*A5.2 used to identify display or control function — 4 3 2 1 0

III CONTROL ROOM REVIEW

Panel _____

A PANEL LAYOUT and DESIGN (Continued)

A5.3	used to identify number of instrument for maintenance/test purpose	4 3 2 1 0
A5.4	used to idenfify power source	4 3 2 1 0
A5.5	used to identify operational limits or warnings	4 3 2 1 0
A5.6	used to identify panel by number and function in generic sense	4 3 2 1 0
A5.7	consistent in nomenclature, use of acronyms, abbreviations, etc. (list on Comment Form and attach)	4 3 2 1 0

III CONTROL ROOM REVIEW

Panel _____

A PANEL LAYOUT and DESIGN (Continued)

A5.8	consistent in type style and the application of type size (i.e., larger letters in headings, all letters same height, etc.)	4 3 2 1 0
A5.9	visually distinctive (light letters on dark background or dark letters on light background)	4 3 2 1 0
A5.10	easily read when stationed at the panel (see A1.1)	4 3 2 1 0
*A5.11	succinctly worded and clear with respect to function or input signal	4 3 2 1 0
A5.12	consistently positioned above or below devices and readily associated with corresponding controls and displays	4 3 2 1 0
A5.13	permanent but replaceable	4 3 2 1 0
A5.14	conspicuous and visually distinctive from the panel background	4 3 2 1 0
A5.15	oriented to read from left-to-right?	4 3 2 1 0

III CONTROL ROOM REVIEW

Panel _____

A PANEL LAYOUT and DESIGN (Continued)

A7 From the operator's primary control area:

A7.1	is the path to the control panel unobstructed	4 3 2 1 0
A7.2	are control surfaces visible	4 3 2 1 0
A7.3	are communications systems accessible	4 3 2 1 0
A7.4	are annunciator windows visible and identifiable?	4 3 2 1 0
A7.5	are computer console and output devices accessible	4 3 2 1 0

PETE ANDERSON 8/4/82
DON LANNING

A+B

III CONTROL ROOM REVIEW

Panel FRONT

B INSTRUMENTATION and HARDWARE

B1 Are controllers that require manual operation:

B1.1 easily reached (see A3.6) 4 3 2 (1) 0

*B1.2 designed to facilitate precise control where fine adjustments are required 4 3 2 (1) 0

SEE ADD'L ON BACK OF THIS PAGE

B1.3 marked to clearly show manual or automatic mode 4 (3) 2 1 0

FCH-K-616 & 619 (CHC FLOW CONTROLLERS) NOT LABELED

A/M/MAN LABELS NOT VISIBLE FROM STANDING POSITION

*B1.4 provided with mechanical stops at the beginning and end of travel 4 3 2 (1) 0

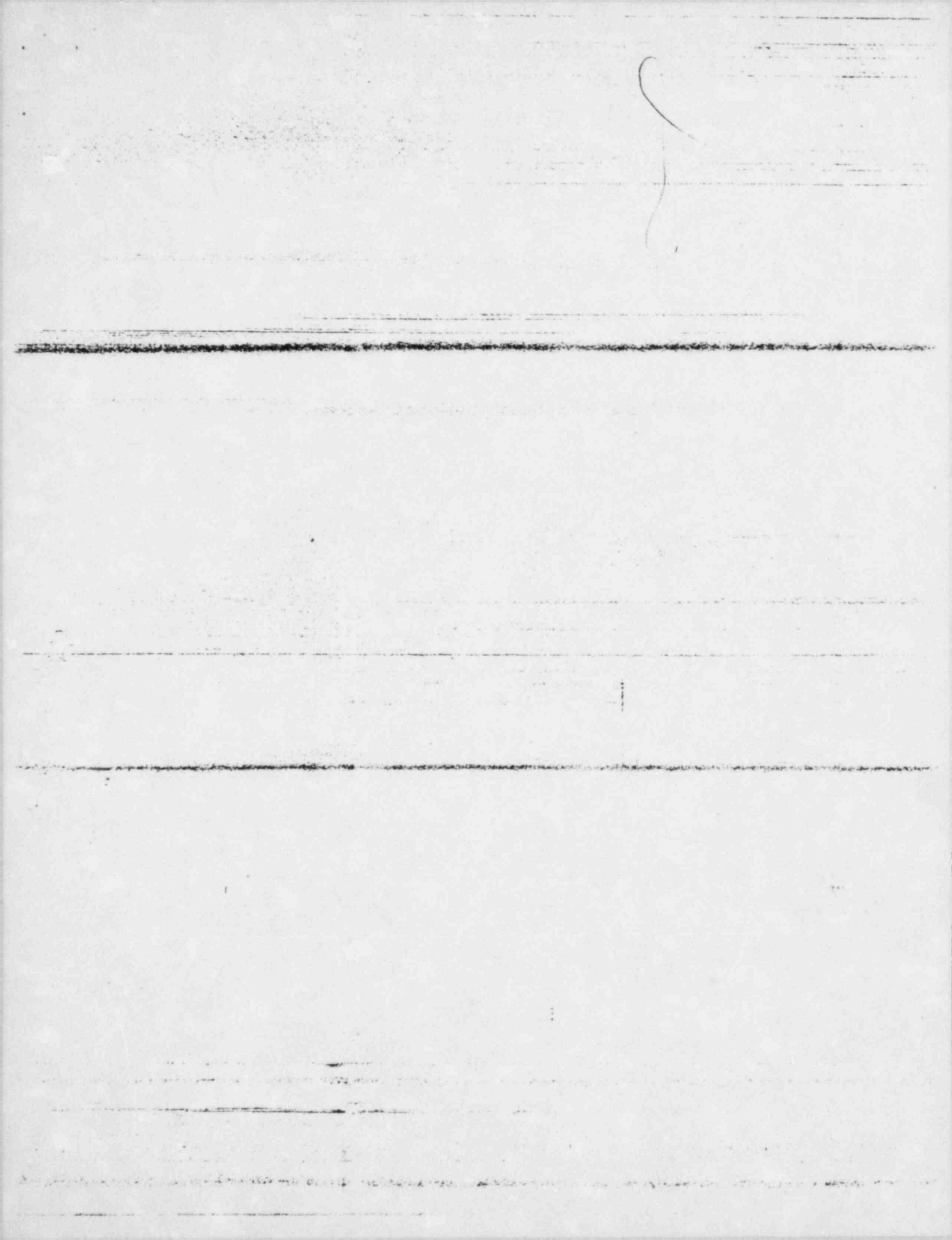
B1.5 provided with space for hand support? (4) 3 2 1 0

B2 Are indicating devices:

B2.1 marked to show normal or abnormal, safe or unsafe, or expected or unexpected range of operation where applicable (4) 3 2 1 0

B2.2 free from glare and parallax when stationed at the panel (see A1.1) 4 3 (2) 1 0

*B2.3 scaled in process units that relate to system operation 4 3 (2) 1 0



B1.

RHR FLOW CONTROLLERS ARE NOT LABELED

RHR Hx OUTLET VALVE CONTROLLERS HAVE NO ID NUMBERS

SI ACCUMUL. VENT CONTROLLER " " " "

B.2 LABELS ON LOWER INDICATORS (CBS PUMP A & B SUCT & DISCH PRESS AND SI PUMP A & B FLOW & DISCH PRESS) SHOULD BE LOCATED ON THE TOP OF THE INDICATOR FOR EASIER READING - THIS WOULD ALSO MAKE THE [illegible] MORE SCREEN ACCESSIBLE

Panel _____

B INSTRUMENTATION and HARDWARE (Continued)

B2.4 provided with visual contrast or distinctiveness between scale graduations, process units, numerals, background and pointer — 4 3 2 (1) 0

B2.5 designed so that pointers do not obscure graduation marks, numerals or process units — 4 3 2 1 (0)

POINTERS SOMETIMES OBSCURE SCALE MARKINGS, BUT DO NOT COMPLETELY OBSCURE THE VALUE

Note: Controllers scales are covered by Pointers and Scale marks are not used for interpolation.

B2.6 designed so that pointers move from bottom-to-top, left-to-right or clockwise, depending on the display design and orientation — 4 3 2 (1) 0

*B2.7 designed so that indicator direction corresponds to control movement — 4 3 2 1 (0)

*B2.8 easily correlated with backup indications, especially those instruments with elevated zeros — 4 3 2 (1) 0

B2.9 aligned between pointer or moveable indicator and scale without need for visual extrapolation — 4 3 2 (1) 0

B2.10 visually aligned and provided with identical scales to facilitate comparative reading in groups of similar displays — 4 3 2 (1) 0

III CONTROL ROOM REVIEW

Panel ________

B INSTRUMENTATION and HARDWARE (Continued)

*B2.11 marked with subdivisions that are consistent with the accuracy needed by the operator — 4 3 (2) 1 0

SEE NOTE UNDER B2.3

B2.12 scaled with a maximum of nine intermediate graduations between numbered markings — 4 3 2 (1) 0

B2.13 scaled with subdivisions in decimal multiples of 1, 2 or 5 — 4 3 (2) 1 0

IS UPSIDE DOWN

B2.14 marked or color coded to provide visual distinctiveness between the case, panel or similar components — 4 3 2 (1) 0

B2.15 marked with numerals oriented in an upright position — 4 3 2 (1) 0

*B2.16 designed so that a failure mode is evident — (4) 3 2 1 0

B2.17 marked or color coded to differentiate between scales on multiple range meters — 4 3 2 1 (0)

B3 For recorder charts:

B3.1 are printed values easily read and distinguishable — 4 (3) 2 1 0

Panel _____

B INSTRUMENTATION and HARDWARE (Continued)

B3.2 are printing devices properly aligned such that printed value corresponds to scale value — 4 3 2 (1) 0

B3.3 is the alarm point identified and does it correspond to scale value — 4 3 2 1 0

NONE IDENTIFIED - SCALES TO BE CHANGED IN THE FUTURE TO PROPER ENG. UNITS

B3.4 is there adequate clarity of markings on multi-pen recorders — 4 3 2 1 0

*B3.5 where fast tracking rates or trends are periodically required, is there Hi/Lo speed capability and do administrative procedures require chart notation — 4 3 2 1 0

B3.6 is point select capability available on multi-point recorders — 4 3 2 1 0

B3.7 is recorder clearly marked indicating proper type and size of chart paper — 4 3 2 1 0

*B3.8 is paper replaceable without physically disconnecting wiring or linkage — 4 3 2 1 0

*B3.9 can the ink supply be maintained without disconnecting wiring or linkage — 4 3 2 (1) 0

DIFFICULT - INK CAN'T BE ON FINGERS!

III CONTROL ROOM REVIEW

Panel _____

B INSTRUMENTATION and HARDWARE (Continued)

B3.10 are pen colors consistent from one recorder to another and/or is the color association unambiguous and clearly displayed — 4 3 2 1 0

LABELS MISSING SO UNABLE TO VERIFY

*B3.11 does chart paper not bind, eliminating frequent manual corrections — 4 3 2 1 0

NOT OPERATING - UNKNOWN

*B3.12 has administrative procedure been established for chart marking and used chart/record retention. — 4 3 2 1 0

UNKNOWN

B3.13 are they free from glare and parallax when stationed at the panel (see A1.1) — 4 3 2 1 0

B3.14 are they marked to show normal or abnormal, safe or unsafe, or expected or unexpected range of operation where applicable? — 4 3 2 1 0

NOT APPLICABLE

B4 For indicating lights:

B4.1 does intensity provide adequate visual distinction between lit and extinguished lights — 4 3 2 1 0

*B4.2 does the use of lit indicating lights consistently indicate a positive state or positive response (an unlighted condition only indicates "power off") — 4 3 2 1 0

Panel _____

B INSTRUMENTATION and HARDWARE (Continued)

B4.3 is the size and intensity of alarm lights adequate to command attention — 4 3 2 1 0

PANEL NOT EVALUATED

*B4.4 is there a lamp test feature when the use of dual or redundant indication is not applied — 4 (3) 2 1 0

NO LAMP TEST FOR ANNUNCIATOR PANEL OR FOR ANY OF PUMP/VALVE LAMPS

*B4.5 is bulb replacement easily and safely performed — 4 (3) 2 1 0

STATUS LIGHT COVERS, NO TRIP INDICATION STATUS LIGHT COVERS, LOCAL TEST POSITION COVERS ARE "FINGERNAIL REMOVAL". STATUS LAMPS & ANNUNCIATOR LIGHTS WILL REQUIRE A LADDER TO CHANGE

B4.6 are sets of lights in alignment to facilitate comparison between related system elements — (4) 3 2 1 0

STATUS LIGHTS FOR TRAIN A & B ARE REVERSED (TRAIN A ON THE RIGHT INSTEAD OF THE LEFT) — SEE TOP OF THIS PAGE FOR MORE

*B4.7 is direct indication used in preference to implied indication that a function has been performed — 4 3 2 1 0

UNKNOWN

*B4.8 when direct indication is not practical, is there backup instrumentation to indicate that a function has occurred? — 4 3 2 1 0

UNKNOWN

B5 For switches: SEE BACK OF THIS PAGE

B5.1 do handles move consistently in the same direction in accordance with expectations (i.e., right for on or start; left for off or stop; center for tripped, standby, or normal; pull-to-lock, etc.) — 4 3 2 1 0

[illegible] PANEL MAINTENANCE/TEST SWITCH [illegible] TO ACTUATE WHICH IS NOT CONSISTENT WITH OTHER SIGNAL ACTUATION SWITCHES

B 4.6

SI / CS MONITOR STATUS LIGHT BOARD – NO LOGIC TO THE ARRANGEMENT OF THE LIGHTS ON THE PANEL

CENT ICCS STATUS LIGHTS – NOMENCLATURE ON TRAIN B STATES VALVES ARE "CLOSED" – TRAIN A DOESN'T STATE "CLOSED" – INCONSISTENT

NO LABELS ON "LOCO LOC RECIRC TRAIN B MONITOR" STATUS LIGHT PANEL

B5 Rx TRIP SWITCH SHOULD BE LABELED "ACTUATE" VS "TRIP" TO BE CONSISTENT WITH SWITCH ON SCET E

CENT TUBE SPRAY SIGNAL RESET SWITCH LABEL SHOULD BE CHANGED TO READ "RESET" VS "ACK"

T SIGNAL MAN ACTUATION SWITCHES – LABELS FOR TRAIN A / TRAIN B (CENTRAL CONTROL) ARE REVERSED – SAME FOR "E" SIGNAL RESET LABELS

ECCS / PCC RECIRC SIGNAL RESET SWITCH – LABELS SHOULD BE TRAIN FOR TRAIN B

III CONTROL ROOM REVIEW

Panel _____

B INSTRUMENTATION and HARDWARE (Continued)

B5.2 is each position clearly marked — 4 3 (2) 1 0

SI-SS-2440 KEY SWITCH POSITIONS NOT MARKED

B5.3 is each reachable at a normal operating distance — 4 3 2 (1) 0

B5.4 are handles that are located near the edge of the control panels protected with a guard to prevent inadvertent operation — 4 3 2 1 (0)

*B5.5 do handles require normal hand pressure to operate (i.e., no thumb-busters) — 4 3 2 (1) 0

B5.6 are handles durable and of adequate size — 4 3 2 (1) 0

*B5.7 is switching action responsive and precise — 4 3 2 (1) 0

B5.8 are associated displays, indicating lights, and labels free from visual obstruction by hand or arm when the switch is operated — 4 3 2 (1) 0

B5.9 is there adequate hand space between them — 4 3 2 (1) 0

III CONTROL ROOM REVIEW

Panel _____

B INSTRUMENTATION and HARDWARE (Continued)

B5.10 is physical distinction provided between pumps, valves, indicating lights, divisional separation, power source, etc. 4 3 2 1 0

→ RE ITEM SHOULD BE MORE DISTINCTIVE

B5.11 are handles or knobs shaped so as to clearly indicate position without obstruction of legends or confusion of direction? 4 3 2 1 0

CE TYP. PLANT TEST AS PART OF POWER ASCENSION PROGRAM.

B6 Are switches for emergency or abnormal use (such as turbine trip, scram, emergency trip, etc.):

B6.1 clearly marked 4 3 2 1 0

B6.2 protected from inadvertent operation 4 3 2 1 0

B6.3 readily accessible 4 3 2 1 0

*B6.4 controlled by specific procedural instructions? 4 3 2 1 0

B7 Where key-lock switches are used:

*B7.1 is immediate actuation not required during plant operation 4 3 2 1 0

B7.2 are keys conveniently located and immediately available 4 3 2 1 0

III CONTROL ROOM REVIEW

Panel _____

B INSTRUMENTATION and HARDWARE (Continued)

B7.3	are keys clearly identified for specific use	4 3 2 1 0
*B7.4	do procedures provide specific instructions for use	4 3 2 1 0
*B7.5	is switch action smooth and positive without use of excessive force?	4 3 2 1 0

PETE ANDERSON
DAVE LANNING 8/4/92

A+B
FRONT

III CONTROL ROOM REVIEW

Panel _____

C NON-COMPUTER ALARM/STATUS LIGHTS

C1 Are alarm/status lights grouped:

C1.1 within annunciator box by specific systems — 4 3 (2) 1 0

SEE COMMENT ON BACK OF PG 29
REFERENCE TO ITEM B4.6

C1.2 above related controls and displays — (4) 3 2 1 0

SAME

C1.3 such that warning and diagnostic alarms are segregated from informational and advisory displays? — 4 3 2 (1) 0

C2 Are alarm/status windows:

C2.1 consistent in nomenclature, use of acronyms, abbreviations, etc. — 4 3 (2) 1 0

SEE 2ND COMMENT ON BACK OF PG 29 UNDER B4.6

C2.2 consistent in type style and the application of type size — 4 3 (2) 1 0

FOR WORDS SMALL TYPE SIZE MUCH TOO SMALL

C2.3 easily read when stationed at the panel — 4 3 (2) 1 0

SOME OF THE STATUS LIGHTS ARE DIFFICULT TO READ BECAUSE OF BRIGHT & SIZE OF TYPE

C2.4 in accordance with checklist criteria for changes or modifications (see A6) — 4 3 2 1 (0)

*C2.5 succinctly worded and accurate with respect to input signal function — 4 3 2 1 0

UNKNOWN

Panel _____

C NON-COMPUTER ALARM/STATUS LIGHTS (Continued)

C2.6 provided with setpoints for parameters with multiple trip levels (water level, vacuum, containment pressure, etc.) 4 3 2 1 0

C2.7 without multiple choice indication (high/low level/pressure) 4 3 2 1 0

C2.8 prioritized for required response level by legend plate color (preferred) or bulb color in accordance with color use standards (see A4.1) 4 3 2 1 0

C2.9 provided with an alphanumeric code in addition to legends for prompt response and positive procedure identification? 4 3 2 1 0

APPENDIX E

LIST OF PROCEDURES REVIEWED

3 - Major Plant Evolutions

OS1000.01	Heatup from Cold Shutdown to Hot Standby
OS1000.07	Approach to Criticality
OS1000.02	Plant Startup from Hot Standby to Minimum Load

8 - Emergency Procedures

OS1300	Rx Trip/Safety Injection
OS1310	Loss of Reactor Coolant
OS1320	Loss of Secondary Coolant
OS1330	Steam Generator Tube Rupture
OS1356.1	Pressurizer Flooding
OS1356.3	Voids in the Reactor Vessel
OS1342	Reactor Trip Recovery
OS13ECA.2	Loss of All AC Power

14 - Operating Procedures

ON1031.02	Starting and Phasing the Turbine Generator
ON1035.03	MFP 'A' Operations
ON1038.01	Circulating Water System Startup
ON1033.01	Mechanical Vacuum Pump Operations
ON1031.01	Placing the Turbine Generator on Turning Gear
ON1035.02	Startup Feed Pump Operations
OS1001.05	Reactor Coolant Pump Operations
OS1008.01	Chemical and Volume Control System Makeup Operations
OS1013.03	RHR Train A Startup and Operations
OS1007.01	Auto and Manual Rod Control
OS1016.05	Service Water Cooling Tower Operation
OS1026.01	Starting Paralleling Loading and SID of DG1A
OS1023.67	Containment Ventilation Operations
OS1027.01	Preparing a Steam Generator for Operation

APPENDIX F

PROCEDURE TALK-THROUGH EXAMPLE

Startup Procedure
General Comments

8/13/82
DDR

1) OS 1027.01 S/G Start up Step 6.2.2
Need labels on controllers
and Step 6.2.3
Need indication of Feed pump rate in gpm (or change wording of the Procedure

2) OS1001.05 RC Pump Section 4. Limitations + Set points
the values are

Normal	Minimum	Maximum

can this arrangement be confusing?

3) Also Section 4 Pump Motor current limits
324 Amps to 336 Amps is barely one small graduation on the meter - if these limits are required, a narrow range meter is needed.

4) Check leakoff flow reading scales to assure low flow of 0.2 gpm and less is a readable range (may need narrow range)

5) also
Step 4.9 (Section 4) — limits on PCCW Vs RC temps need to be displayed or alarmed?

6) question if RCP Trends (Step 6.1.3) can 13 Parameters per S/G
be handled by the Computer memory (13 x 4 array)
also might consider Graphics rather than
Computer Printout

7) Panel D Seal flows are in A C B D order
(why not A B C D ?)

8) Panel C need to Consider Panel revision
Put bearing left Pump switches first
i.e reverse with stand pipe switches to
make better sequence consistent with operation

Main Procedure

1) Step 7.1.9.3 need to indicate which
monitor to use. There is no low range
Pressurizer Pressure, must use the Hot leg
pressure (low range) and need to refer
to pressure Temp Curve during heat up.

Procedure OS1013.05 RHR Shutdown

1) Step 7.3.1.1 There is no position
indication for HCV 606 Closed (only dial indicat
on the flow control dial) Flow meter above also not an indicato

2) Step 7.3.1.2 labeling on FCV 610 pump
should say mini not Min flow (Pre Start)
7.3.1.4 Panel B RCV-22 + 23 labels are
not Consistent with Procedure (loop suction Valves)

3) FCV-608 Procedure calls for Auto in Step 7.3.1.6 but label is not marked Auto (there is a modulate position)

Procedure ON1038.01 Arc Rotate System

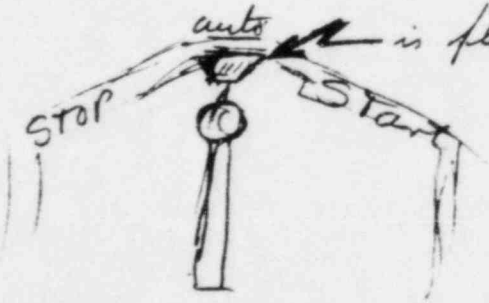
1) Step 3.1 two minutes limit (exact) needs some ± allowance

2) 6.1.3 Panel C Amp meter may not be of sufficient range - (normal and limits not known)

Procedure ON1031.01

1) Step 4.2 Nomenclature "First Stage metal Temp" is not on ER Panel (Recorder states Stage Shell?)

2) 6.3.1 - EBOP Switch - auto is center with spring return to center - not clear from which return the system is on auto



is flag supposed to be on Green (stop) or Red (start) when auto is actuated

3) 6.3.3 Bearing Pressure Turbine Protection verification - there is no control room indication for the required verification (Only Local)

4) 6.4.1 to verify amber light "off" indication of correct Pressure ± should a lamp test check be made?

ON 1035.03

3.2 Reset of Stop valve trip could give Premature Start? Is this a good system - will it be confusing during transients requiring FW Restart?

3.4 Need Min temp and heat rate limits

4.1 Panel 6R FW Supervisory panel limits on vibration not easily correlated with meter reading

6.1.13 Need to clarify where to stop for completion of main procedure Step # 7.1.13.6

Procedure ON 1033.01 (Vac pumps)

1) step 4.0 limitation stated in inches Vacuum Meter on Panel F read in inches absolute

2) Step 6.1.1 Switch labeling "Vent + PAB" not consistent with procedure "Open exhaust Valve" need to clarify double light system labels and procedure

also 6.1.2 + 6.1.3 Double Red lights the Procedure should say left or right red light or some other designation of the first + second light

3) increasing Vacuum decreases the meter reading — See 1) above Should state 28" Hg Vacuum (not 28" Hg)

Main Procedure Step 7.1.18
Hot shutdown boron concentration value or where to obtain the proper value at a given cycle burnup is not discussed or referenced.

Procedure OS1008.01 Boron Concentration
The Boric acid concentration and dilution counters (total gallons required and total gallons delivered)
Need to specify the units (i.e. gallons) and need to clearly define the decimal point position on these counters.

Main Procedure
Step 7.3.2 need to specify which status lights and to check auto logic.

Procedure ON 1035.02
Step 6.1.3 there is no low range feed water flow indication on S/G - Should read 0 pim or else some information on value setting for desired low flow.

Main Procedure

Step 7.3.4 — Bypass valves around MSIV

No position indication (except Closed)

(Not Committed) → Open is on left Closed on Right

Switches and indicator lights are identical – No labels

There is no temperature indication as required by the procedure.

Previous Notes on Item

Composite General Comments 8/12/82

Loss of Off Site Power

1) Emergency lighting at the simulator (question Rais

2) (Note the MSIV BYP V-204 panel light is also a Controller (Panel F) (unusual Condition) No name plates reveal an open and clo and indicator lights that look like the MSIV BYP push button (MSIV) (MSIV BYP) — most steps of procedure

3) Safeguards equip. Status "actuate light" could be re-located for ease of identification (B. Symptoms of the procedure)

4) Confusion about the zero Vc Rod bottom lights first mark is 6 — no explicit zero indication (There are rod bottom lights) — lights not aligned and must stand directly in front to see the lights also no lamp test — (could there be 2250 for each Rod) — Rod Panel Many inaccurate Need new Version

5) Broken Handle — turn too far — Reactor trips on Panel D question of actuation direction

6) The turbine stop valve status lights seem to be lacking for verification of Turbine Trip (there are meter indications)

7) Question about use of S T P = Phase A Containment Pressure, Phase B Containment Isolation Signal — Safety Injection

8) Consistency of labels on Panel H, + meters for E-5 and E-6 to identify Emergency

8/12/82

12) Pull to lock on pumps hard to operate when for back on lower bench Board

13) Question on time sequence for checking the Emergency F.W. Seems too long into Procedure before checking – (W) states ther = 20 mins

OK

14) Some maintenancy in use of switches and Pistol Grips

Mostly Pistol Grips are Pumps
Switches are Valves

on Panel D Rows-P-164 Rx makeup water Pump 16 A & B are switches (like valve switches)

on Panel F the EFW Isolation valves are Pistol Grips

A consistent set would be
Trips and Resets should be Push button

Pistol Grip for Pumps

Switches for Valves

15) Panel E — Emergency FW Valve switches are all red handles (not discriminate Train A from Train B) Steps 9 Should be Red with white Stripe showing both

16) Need Picture — Emergency E. FW. Isolation Valve for open and Close are up side down Panel E (Procedure Steps 9) a series of Pairs of indicating lights show open top Closed Bottom but the E FW lights have Closed on Top and Closed on Bottom Question of which Convention should be used — (better to use left right not up down)

17) The MSIV Inverters should show powered from both Train A + Train B

18) CST level is in Feet — Tech spec is in Gallons. Need Consistency (and Terry thinks Tech Spec numbers are best to use)

19) Procedures 1. that indicate vital from less-vital may be useful on the D.C. Bus to consider conserving D. C. Power and should something be developed (procedure) in the event D. C. voltage drops too low.

Step 13

20) Need labels on H R (each Panel) to distinguish D.C. (Battery) Bus for Vital and Non-Vital
question: if there is a volatag indicator on the AC inverters?
Need color Dots to distinguish the channel power (4 instrument channel at rear of control room have channel colors)
Need Generic labels on each indicator

21) Status Panel for Safety Injection confusion (might change Roman Numeral to color code for channel indicator)

22) Check Spent fuel Panel on BR Consistency with main panel (are lines of Demarcation needed?)

Procedure S1023.31 FN-2A; 2B; 2C; 2D Back Panel C.
1) Switches are not Color Coded or labeled to show Train A + B

901007.01
1) Control Rod Direction arrows in ↓ out ↑ ?
should this be reversed (pull operator)

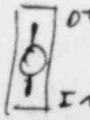


plate right now it is movement with switch

2) Need indicator lights for the by pass breakers around the reactor trip breakers on Panel D next to Reactor Trip Switch.

---

23) Containment Pressure indicators ranges will not allow observation of normal operating range around -1 PSi and the 2PSi trip (need Narrow Range Meter. Reads 0 - 60 PSiG
Is there a recorder (Probably on the computer)
Need trend recorder

S1007.01

Step 6.9.d : There is a problem in reaching the 12 step limit between Demand and Position indicator

General Check list
Major Questions

Operator Interviews

N.P. — Not a Control Room Panel → VAS alarms Difficult to read too Font!
(also Water Treatment Panel Confusing)
CVCS Complicated
F.W Pump Control (Hand Room) – check his B panel

R. S. Safety Panel Confusing (more imaging)

J.M. Safety Panel (ESF) Confusing
VAS too limited

J. C. 1) Core Water but Treatment reverse Core water (3½ mi)
while operating –
2) Safety Injection Confusing
3) Man Room etc problem
4) Pattern Recognition needed

D. K. 1) CVCS – difficult
a) A+B train confuse with 1+2 loops?
3) back A alarms on VAS can get lost

P. R. 1) F.W System Confusing
2) Need easy to deactivate some alarms

P. L. 1) Engineer Safety
2) CWCS complications

Start up Procedure
Phase II

Procedure OS1000.07 Hot standby to Min Load

1) Step 7.3.2 High Flux at chart down Alarm is labeled "Block"; Procedure should say Block

2) Step 7.4.2 Need a clarification of Bank Sequence Refer to Procedure 1007.01 Step 6.3

3) Steps 7.4 Nuclear Instrumentation Panel D need labels Source Range - IRM - Power Range on the recorder the Blue marker can only be seen with the door open and the open door tends to block the view of other instrument. Need to note the chart speed change in the procedure

Need clear marking of 10^{-8} amps not exponents are small number and hard to read

4) Step 7.6.3 Need labels on switches and check for consistency of nomenclature

Procedure ON1035.03

Step 6.1.26 Need terminology consistent between "recirc and mine" between primary and secondary

Step 6.1.40 Needs study and revised wording transfer to 3 element control is complex

(E)

Procedure ON 1031.02 Start turbine Generator
6-E (Panel F) - has ~~no~~ Generic
-labels
Procedure and Panel need some
revision to reduce confusion
Need to recheck when Panel
and procedure are complete.

(4)

STATION OPERATING PROCEDURE COVER FORM

A. IDENTIFICATION

Number OS1027.01 Revision 00

Title PREPARING A STEAM GENERATOR FOR OPERATION

Originator John Kinball

B. TECHNICAL REVIEW

Title	Signature	Date
Dept Supvr/Mgr		

C. QUALITY ASSURANCE REVIEW

Title	Signature	Date

D. SORC APPROVAL

SORC Meeting No. _____

E. YNSD APPROVAL

Title	Signature	Date

F. APPROVAL AND IMPLEMENTATION

Station Superintendent	Approved Date	Review Due Date

AQ 1.02A
Rev. 0

Also Available On Aperture Card

OBJECTIVE	CRITERION	Available	Available	COMMENTS

[redacted]

P30712-0312-01

1.0 OBJECTIVES

This procedure will enable the operator to:

1.1 Drain a steam generator to the startup operating band.

1.2 Fill a steam generator to the startup operating band. — Try this one for a

2.0 REFERENCES

2.1 UE&C P&ID's

9763-F-804992, Rev. 2	9763-F-805037, Rev. 1
9763-F-804993, Rev. 2	9763-F-805039, Rev. 2
9763-F-805003, Rev. 4	9763-F-805636, Rev. 1
9763-F-805004, Rev. 4	9763-F-202074, Rev. 6
9763-F-805005, Rev. 4	9763-F-202076, Rev. 0
9763-F-805006, Rev. 4	9763-F-202079, Rev. 6
9763-F-805020, Rev. 3	9763-F-202084, Rev. 5
9763-F-805021, Rev. 3	9763-F-202086, Rev. 3
9763-F-805024, Rev. 4	9763-F-202110, Rev. 0
9763-F-805025, Rev. 4	

2.2 UE&C Logics Tab 13
Tab 71
Tab 44

2.3 UE&C System Description Tab 3, Main and Auxiliary Steam System
Tab 21, Steam Generator Blowdown System
Tab 94, Chemical Addition and Analysis System

2.4 Westinghouse Steam Side Water Chemistry Control Specifications:
Section 4 Protection Against Corrosion
Section 7 Steam Side Water Chemistry
Section 10 Steam Generator Protection during Inactive Periods

2.5 Westinghouse Vertical Steam Generator Technical Manual 1440-C316.

3.0 PRECAUTIONS

3.1 Whenever possible, close the steam generator blowdown isolation valves in the following sequence to avoid a "water hammer" in the lines when blowdown is reinstated.

3.1.1 Close manual steam generator blowdown throttle valves.

3.1.2 Close steam generator blowdown isolation valves inside reactor containment (IRC).

3.1.3 Close steam generator blowdown isolation valves.

NOTE

THE "WATER HAMMER" IS DUE TO THE BLOWDOWN RAPIDLY EXPANDING SINCE THE DOWNSTREAM LINE OF THE ISOLATION VALVES WOULD BE DRAINED.

OBJECTIVE	CRITERION	Available	Available	COMMENTS
sample task analysis				

3.2 Draining more than one steam generator requires that additional N_2 be available to supplement on site inventories (Later) amount.

3.3 The electrical components of the system will de-energize upon loss of electrical power. Redundant emergency power supplies are not provided.

3.4 Due to the heat load on PCCW, the capacity of the Steam Generator Blowdown System may be limited during heat treatment of the Circulating Water System tunnels and during the initial phase of plant cooldown. N/A

3.5 Do not exceed 99% of wide range level indication when filling the steam generator. This avoids overstressing the main steam lines due to the added dead weight of a flooded line and reduces the potential of a secondary safety valve sticking open following discharge of water or two phase flow.

3.6 Radiation element RE-6519 must be functional at all times when using the Steam Generator Blowdown Recovery System or discharging to the environment via the WTT pump discharge header. N/A

3.7 The steam generator must be continuously sampled whenever discharging steam generator water to the transition structure via the WTT pump discharge header. N/A

3.8 Do not open SB-V57, supply isolation for the steam generator blowdown evaporators/FDT's, if evaporator SB-EV-5A or SB-EV-5B is being purged with nitrogen. N/A

4.0 LIMITATIONS AND SETPOINTS

4.1 REF: (T.S.3.4.10.1)

The Reactor Coolant System temperature and pressure shall be maintained within the limits of the operator's curve, Technical Data Book, page (Later).

4.2 REF: (T.S.3.7.2)

The temperature of both the primary and secondary coolants in the steam generator shall be >70°F when the pressure of either system is >200 psig. The pressure in each side of the steam generator shall be determined to be < 200 psig at least once per hour when the temperature of either the primary and secondary coolant is < 70°F.

4.3 A nitrogen header pressure of 2 to 5 psig must be maintained by employment of automatic pressure regulating equipment whenever the steam generator is drained or in a partially drained condition. Local indicator

4.4 Steam generator feedwater must meet the specifications of (Later). Chemistry

4.5 Steam generator draining rate will not exceed 280 gpm. N/A

4.6 A discharge permit is required prior to environmental discharge via the WTT pump discharge header. N/A

OBJECTIVE	CRITERION	Displays Available	Controls Available	COMMENTS
ocedure l be changed	due to design change			
as stated	wide Range level indication 99%	VAS Alarm at 70 to 80%	Monitor + Control level indicator / wide range per S/G on Panel (E) (F)	
		CRT + Data books		
→		+ (E) (D) (E) except Secondary water Local Administrative Guidelines only (VAS alarm)		
→		Local on PAB No Alarm Not in Computer		

4.7 The Steam Generator Blowdown System is automatically shut down on a "T" signal or loss of air. N/A

5.0 PREREQUISITES

5.1 The N_2 System shall be operable as per procedure OS1024.01.

5.2 The RCS is in mode (5) or 6.

5.3 The RHR is operable and maintaining RCS temperature and pressure within allowable limits of the operator's curve.

5.4 The Sample System is available as per procedure OS1053.02A. line up check sheet

5.5 For draining a steam generator: N/A

5.5.1 Blowdown evaporators SB-EV-5A and SB-EV-5B are not being purged.

5.5.2 The PCCW System is operable and supplying cooling water to the steam generator blowdown components.

5.5.3 RCDT and PRT are isolated from the N_2 header when pressurizing the steam generator(s).

5.5.4 The Steam Generator Blowdown System is available per procedure OS1021.01.

5.5.5 Ensure a circulating water pump or service water pump is operating if discharging steam generator water to the transition structure.

5.6 For filling a steam generator:

5.6.1 The Feedwater System is available from the startup feed pump (SFP) to the steam generator.

5.6.2 The steam generator atmospheric dump valve is operable for over pressurization protection.

6.0 PROCEDURE

6.1 Draining a steam generator to the startup operating band. Go to 6.

6.1.1. Adjust NG-PCV-4602, N_2 header pressure regulator, to establish a header pressure of 2 to 15 psig.

6.1.2 Open NG-V120 and NG-V121, N_2 gas header containment isolation valves, and ensure the N_2 gas header stablizes at 2 to 15 psig.

CAUTION

THE STEAM GENERATOR MUST BE CONTINUOUSLY SAMPLED TO ENSURE CONTENTS BEING DRAINED ARE WITHIN THE SPECIFICATIONS ESTABLISHED BY (LATER) DISCHARGE REQUIREMENTS

OBJECTIVE	CRITERION	Displays Available	Controls Available	COMMENTS
		Verify through System line up		
		Line up and recent Surveillance		
Step 6.2 Pg 6		1		

CAUTION

ENSURE RADIATION ELEMENT RE-6519 IS OPERATIONAL TO TO PREVENT POSSIBLE RELEASE OF RADIOACTIVE MATERIAL THE ENVIRONMENT.

6.1.3 Commence draining the steam generator to the transition structure as follows:

6.1.3.1 Open SB-V54, blowdown isolation to the WTT pump discharge header.

6.1.3.2 Shut SB-V354, Steam Generator Blowdown Recovery System supply header isolation.

6.1.3.3 Open WL-V222 or WL-V223, waste test tanks effluent isolation valve to the intake and discharge transition structure respectively.

NOTE

UNLESS HEAT TREATMENT OF THE CIRCULATING WATER SYSTEM TUNNELS IS IN PROGRESS, WL-V223 WILL NORMALLY BE USED.

6.1.3.4 Open the steam generator blowdown isolation valve.

Steam Generator	A	B	C	D
	SB-V189	SB-V191	SB-V193	SB-V195

6.1.3.5 Open the steam generator blowdown IRC isolation valve.

Steam Generator	A	B	C	D
	SB-V1	SB-V3	SB-V5	SB-V7

6.1.3.6 Open the N_2 supply valve and pressurize the desired steam generator.

N_2 Supply to Main Steam Loop

1	2	3	4
NG-V39	NG-V40	NG-V41	NG-V42

NOTE

MONITOR THE N_2 HEADER PRESSURE DURING DRAINING TO ENSURE A POSITIVE N_2 PRESSURE OF 2 TO 15 PSIG IS MAINTAINED.

6.1.3.7 Slowly open the steam generator blowdown throttle valve to establish a flow of <280 gpm.

Steam Generator	A	B	C	D
	SB-V21	SB-V22	SB-V23	SB-V24

OBJECTIVE	CRITERION	Available	Available	COMMENTS

6.1.3.8 Open SB-CV-6519, blowdown discharge to Service Water and Blowdown Recovery System control valve, from the MCB and place in AUTO.

6.1.3.9 When the steam generator level is between 60 and 70% of wide range indication, stop draining the steam generator as follows:

6.1.3.9.1 Shut the steam generator blowdown throttle valve.

S/G	A	B	C	D
	SB-V21	SB-V22	SB-V23	SB-V24

6.1.3.9.2 Shut the steam generator blowdown IRC isolation valve.

S/G	A	B	C	D
	SB-V1	SB-V3	SB-V5	SB-V7

6.1.3.9.3 Shut the steam generator blowdown isolation valve.

S/G	A	B	C	D
	SB-V189	SB-V191	SB-V193	SB-V195

6.1.3.9.4 Shut SB-CV-6519, blowdown discharge to Service Water and Blowdown Recovery System control valve.

6.1.3.10 Open SB-V354, Steam Generator Blowdown Recovery System supply header isolation.

6.1.3.11 Shut SB-V54, steam generator blowdown isolation to the WTT pump discharge header.

6.1.3.12 Shut WL-V222 or WL-V223 whichever was opened in step 6.1.3.3.

6.1.3.13 Shut the N_2 supply valve to the affected steam generator.

N_2 Supply to Main Steam Loop-

1	2	3	4
NG-V39	NG-V40	NG-V41	NG-42

6.1.3.14 Shut NG-V120 and NG-V121, N_2 gas header containment isolation valves.

6.2 Filling a Steam Generator to the Startup Operating Band.

6.2.1 Notify chemistry to mix steam generator chemicals as per procedure (Later) if required.

OBJECTIVE	CRITERION	Available	Available	COMMENTS
Steam Generator Protection			Verbal request	Delay in starting in not ready

6.2.2 Shut both steam generator main feed pumps' discharge isolation valves from MCB.

SGFP P-32A — FW-V2

SGFP P-32B — FW-V13 — controller (speed)

CAUTION
UNLESS BOTH PRIMARY AND SECONDARY WATER TEMPERATURES ARE >70°F. USE THE STEAM GENERATOR ATMOSPHERIC DUMP VALVE FOR OVERPRESSURE PROTECTION.

6.2.3 Start the startup feed pump per procedure OP1035.02 and establish a feed rate of (Later) gpm by throttling feed regulating valve bypass for appropriate steam generator.

Steam Generator	A	B	C	D
	LK-4210	LK-4220	LK-4230	LK-4240

6.2.4 Commence adding chemicals to the steam generator per procedure ON1053.02 as required.

6.2.5 Fill and maintain the steam generator level between 60 and 70% of wide range indication.

6.2.6 Monitor steam generator pressure and vent as necessary with the atmospheric dump valve.

OBJECTIVE	CRITERION	Available	Available	COMMENTS
		Control Switch Indicator light.	(E)	
		Local Temp monitor		
	→	Indicators do not read in GPM	FW Controller manual mode	Note Procedure OH:035.02 is reviewed under main Procedure Step 7.3.3
Return To Main Procedure				